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NATIONAL DAM INSPECTION PROGRAM. UPPER OWL CREEK DAM (NDS-PA-00--ETC(U)
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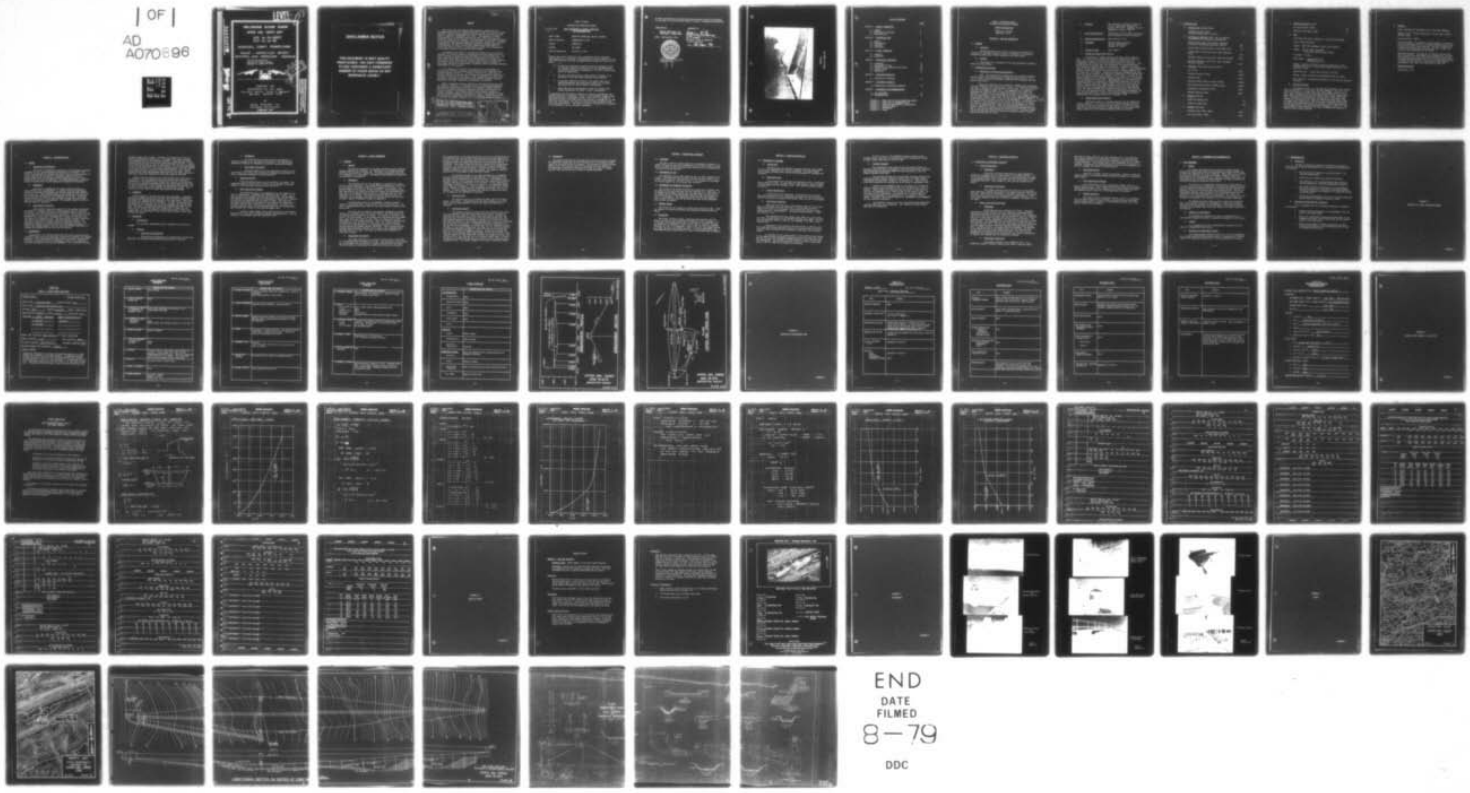

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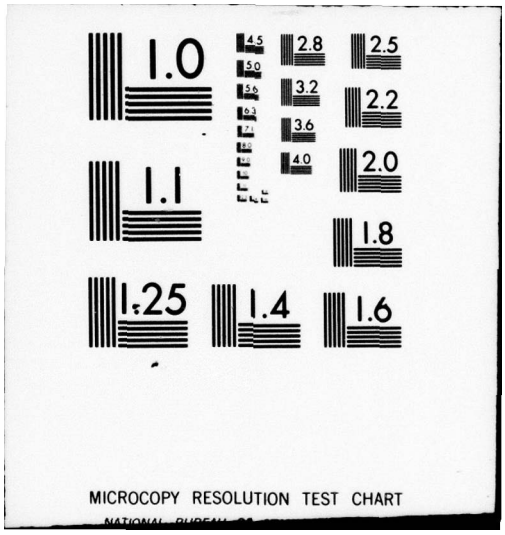
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DELAWARE RIVER BASIN

UPPER OWL CREEK DAM

NDS No. PA-00673
DER No. 54-96

SCHUYLKILL COUNTY, PENNSYLVANIA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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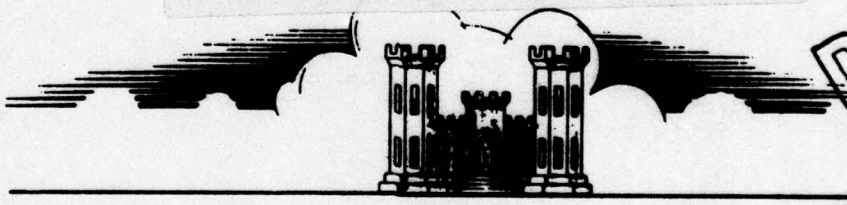

PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

BY

Berger Associates, Inc.
Harrisburg, Pennsylvania

FEBRUARY 1979

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PREFACE

This report has been prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evoluntionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

[CONT'D FROM P. 1]

BRIEF ASSESSMENT OF GENERAL CONDITIONS AND RECOMMENDATIONS

Name of Dam:	**UPPER OWL CREEK DAM, NDS NO. PA-00673**
State & State No.	**PENNSYLVANIA, 54-96**
County:	**SCHUYLKILL**
Stream:	**OWL CREEK**
Date of Inspection:	**October 26, 1978**

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in fair condition. The following recommendations are made for action by the owner:

1. **A qualified professional engineer should be engaged to study the seepage condition beyond the toe of the dam embankment. Any corrective measures recommended on the basis of that study should be implemented.**

2. **The top of the dam should be made uniform in height, to an elevation of four feet above spillway crest elevation.**

3. **An entrance should be provided to the intake tower and a regular maintenance and operating procedure for the drawdown gates and the valves should be established.**

4. **Brush and trees on the embankment should be removed and a regular maintenance procedure should be implemented.**

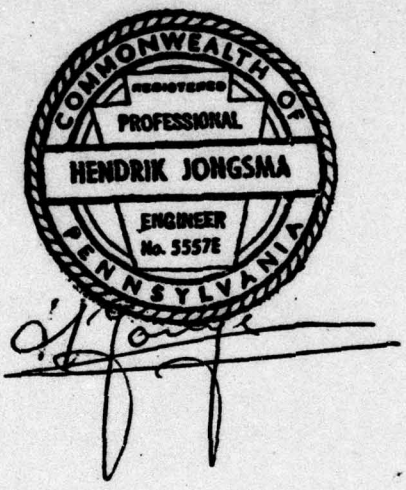
In accordance with the Corps of Engineers' evaluation guidelines, the spillway capacity is inadequate to pass the PMF (Probable Maximum Flood) peak inflow without overtopping the dam. The project is capable of passing 45 percent of the PMF without overtopping. Although the 1/2 PMF will cause overtopping, the depth of overflow is not considered sufficient to cause failure. The spillway capacity is, therefore, considered to be inadequate, but not seriously inadequate.

A formal surveillance and downstream warning system should be developed by the owner to be used during periods of high or prolonged precipitation.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: February 20, 1979



APPROVED BY:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

DATE 18 Mar 79

OVERVIEW

UPPER OWL CREEK DAM

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

UPPER OWL CREEK DAM

NDS-ID NO. PA-00673
DER-ID NO. 54-96

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States.

B. Purpose

The purpose is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

Note: The construction drawings used the original streambed as the project datum elevation and a spillway elevation of 33. The U.S.G.S. shows a spillway elevation of 1092 and this elevation has been used in this report.

Upper Owl Creek Dam is an earthfill embankment with a concrete core wall located on the centerline of the dam. The 9-inch thick concrete core wall is founded on rock over most of its length. The left end of this wall is founded on sandy clay. The embankment has a length of approximately 1300 feet with a maximum fill height of 38 feet. The spillway is located in the right abutment and has a crest length of 50 feet at approximately 4 feet below the top of dam. The spillway discharge channel makes a sharp curve to the left and narrows down to a narrow ditch which nearly parallels the toe of the embankment. An intake tower is located at the upstream toe of the dam in the center of the valley. Two 20-inch concrete encased pipes run under the embankment to a valve house at the downstream toe. Water can be discharged directly into a channel leading to a reservoir located immediately downstream from this dam, or can be discharged through an aeration system. The water intake for the Borough water system is located at another reservoir located downstream (see Section 3.1.E).

[CONT'D ON P. ii]

B.	Location:	Rahn Township, Schuylkill County, PA U.S.G.S. Quadrangle, Tamaqua, PA Latitude 40°-47.8', Longitude 75°-55.4' (Appendix F, Plates I and II)
C.	Size Classification:	Intermediate (38 feet high, 1,110 acre-feet at present low crest elevation)
D.	Hazard Classification:	High (Section 3.1.E)
E.	Ownership:	Tamaqua Borough Authority 320 East Broad Street Tamaqua, PA 18252
F.	Purpose of Dam:	Water supply

G. Design and Construction History

The Borough of Tamaqua required additional water supply in 1914. Mr. John H. Lance, Consulting Engineer, Wilkes Barre, Pennsylvania, wrote a report reviewing the existing facilities and the recommended construction of a new storage reservoir on Owl Creek. This new dam would be located 3500 feet upstream of an existing dam from which pipelines supplied water to the Borough. A permit for construction of the new dam was issued on June 24, 1919, and B. G. Coon Construction Company started construction in the next month. Resident Engineer for Mr. Lance was a Mr. Rekate. Progress was slow and workmanship was poor. After the winter shutdown, the Waterworks Commission of the Borough took over the construction by force account. Mr. W. Lance, a brother of the design engineer was the resident engineer during that year, but workmanship and progress was still poor. Representatives of the Department of Forests and Waters, predecessor of Pennsylvania Department of Environmental Resources made very regular progress inspection visits and the reports indicate that often large boulders were in the fill and that compaction was not accomplished by rollers, but by the teams dumping fill. The larger boulders were permitted downstream of the core wall but not in the upstream section. After the second winter shutdown, the work was contracted out to Central Construction Company, Harrisburg, Pennsylvania, who completed the work in September, 1921.

H. Normal Operating Procedures

This dam is used as a storage reservoir for the downstream intake reservoir. If the pool level falls below spillway elevation, releases can be made by opening the gate valves on the 20-inch pipes. Most of the time, the releases are made through a 6-inch bypass pipe, which releases the water through standing pipes for aeration.

1.3 PERTINENT DATA

A.	**Drainage Area** (square miles)	
	Computed for this report (Original design used 1.7 sq.mi.)	1.5
B.	**Discharge at Dam Site** (cubic feet per second) See Appendix C for hydraulic calculations.	
	Maximum known flood, 1955 (Hazel) estimated on basis of approximate pool Elev. 1093.4	280
	Outlet works low-pool outlet at pool Elev. 1070	62
	Outlet works at pool level Elev. 1092 (spillway crest)	116
	Spillway capacity at pool Elev. 1096 (top of dam)	1,420
	Spillway capacity at pool Elev. 1095.4 (present low point of dam)	1,110
C.	**Elevation** (feet above mean sea level)	
	Top of dam	1,096
	Present low point of dam	1,095.4
	Spillway crest	1,092
	Upstream portal invert of outlet tunnel	1,059.5
	Downstream portal invert of outlet tunnel	1,058.5
	Streambed at centerline of dam	1,058
	Maximum tailwater about	1,061
D.	**Reservoir** (miles)	
	Length of maximum pool	.76
	Length of normal pool	.68
E.	**Storage** (acre-feet)	
	Spillway crest (Elev. 1092)	860
	Top of dam (Elev. 1096)	1,160

F. Reservoir Surface (acres)

Top of dam (Elev. 1096)	84
Spillway crest (Elev. 1092)	67

G. Dam

See Plates III and IV, Appendix F, for plan and sections.

Type: Rolled earthfill.

Length: 1300 feet embankment and 50 feet spillway.

Height: 38 feet above streambed.
52 feet above bottom cutoff trench.

Top Width: 10 feet.

Side Slopes: Upstream 2H to 1V.
Downstream 2H to 1V.

Zoning: Concrete core wall located on centerline of dam, extending from 10 to 12 feet below original ground to 1 foot below top of dam.

Impervious Core: 9-inch thick concrete core wall.

Cutoff: Trench excavated on centerline dam for core wall.

Grout Curtain: 4-inch pipes installed in core wall for grouting. Not used.

H. Outlet Facilities

The intake facility is a ten-foot inside diameter tower located near the upstream toe of the dam at the old streambed. Access to the tower is by means of a single span steel truss bridge from the top of dam. Water is admitted to the tower through five 18-inch square sluice gates with centerline elevations of 1061.5, 1076.5, 1082, 1086.5 and 1090. The water entering the tower through any of these gates flows through two 20-inch cast iron pipes to a downstream valve house, where each pipe has a double valve. The water can be released directly into an asphalt paved discharge channel or through a 6-inch bypass between the two main valves to an aeration system (Appendix E, Plate II). The latter method is used nearly all the time if releases are required to feed the lower intake reservoir.

I. Spillway

Type: Uncontrolled triangular weir in the right abutment.

Length of weir: 50 feet including a 3.0 foot pier, sloping abutment walls.

Crest Elevation: 1092.0.

Upstream Channel: The approach to the spillway is excavated out of the hillside and is on a slightly upward grade to about 6 inches below weir crest elevation. The weir is obstructed by grout pipes projecting out of the weir and a 2-foot x 6-inch wide pier supporting the footbridge.

Downstream Channel: The width of the spillway narrows fast below the weir with the sloping walls converging in a 65-feet long transition to a chute four feet wide and 2.5 feet deep. The chute runs downstream of the toe of the embankment through a wooded area and joins the outlet channel about 200 feet downstream of the valve house (Appendix E, Plate III).

J. Regulating Outlets

See Section 1.3.H.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

A. Hydrology and Hydraulics

The files of Pennsylvania Department of Environmental Resources (PennDER) did not contain hydraulic design data for this dam. The report on application for construction states that the spillway would be 5 feet below the top of dam with a discharge capacity of 920 cfs. During construction the designer requested reducing the size of the spillway, but this was not permitted. No design hydrographs, discharge curves, storage curves or other hydraulic information is available.

B. Embankment

The files of PennDER did not contain design criteria or a design analysis for the embankment. A general plan and longitudinal section on a drawing dated August 1915 has been reproduced in Appendix F, as Plate III. This drawing indicates that twenty-one test pits and drill holes had been made near the centerline of the dam. Overburden varied in depth up to 60 feet and consisted of loamy earth and sandy clay and is overlying a red sandstone. The proposed typical section is shown on Plate IV, Appendix F.

C. Appurtenant Structures

The available design data consists of the drawings reproduced in Appendix F. Design criteria or design analyses were not available for review. The intake structure is a reinforced concrete tower with an inside diameter of 10 feet and 2 foot thick walls. The footing is at an elevation of 4.5 feet below streambed and if placed at that elevation the tower is not founded on rock. The two pipes are encased in concrete and placed in a trench at least 3 feet below original ground. The spillway is shown as a stonelined channel, paved with concrete. The trapezoidal channel was located close to the embankment abutment as shown on the design drawing. The core wall was extended underneath the spillway and extends about 30 feet into the sidehill.

2.2 CONSTRUCTION

Construction of the dam and appurtenant structures took place over a period of three years with different construction companies and resident engineers. State representatives made frequent inspection trips during the first two years due to poor workmanship. Most of the complaints concerned the material used for the embankment, which contained too many

boulders larger than 6 inches. Placement and compaction of the fill was also considered unsatisfactory. In general, the larger boulders were permitted only in the downstream section. Compaction was accomplished during the first year by the teams bringing in the fill. Later a heavy tractor was used to pull the dump wagon. The core wall was placed on rock in the right half, but in the left half the core wall was founded on the clay about 10 to 12 feet below original ground. The core wall was poured in varying sections in heights of about 4.5 feet. Photographs indicate that reinforcement was placed in these walls and that 4-inch grout pipes were inserted over the full length of the wall.

Borrow areas were located in the left hillside and in the area of the spillway. The excavation of the latter borrow area required a relocation of the spillway chute further away from the toe of the dam. Due to lack of funds,no discharge channel was constructed initially and the water was allowed to flow through the unprotected borrow area. Due to heavy erosion, the present channel was constructed in 1928. The first part of the chute is steeper than shown on the drawings.

2.3 OPERATION

Formal records of operation have not been maintained. Inspection reports by PennDER indicate that in 1922, one year after construction was completed, leakage existed adjacent to the valve house. Weirs were installed, but readings are not available. In 1928, the spillway weir and abutments were repaired, due to severe cracking, and the spillway chute was lined. The downstream slope was regraded and seeded in that year. The spillway bridge was also replaced and a bridge pier was constructed. In 1923, an inspection report states that a large flow existed 150 feet downstream of the toe and about 100 feet to the right of the valve house.

2.4 EVALUATION

A. Availability

The available engineering data is contained in the files at PennDER.

B. Adequacy

1. Hydrology and Hydraulics

The available information is not sufficient to review the hydrologic and hydraulic engineering analyses made for this dam.

2. Embankment

The files did not contain sufficient information to review the design of the dam based on soils data. The construction drawings are adequate to determine the general construction details.

3. Appurtenant Structures

Although design data of the appurtenant structures were not available for review, the construction drawings are sufficient to make a reasonable assessment of these structures.

C. Operating Records

Formal operating records are not available for review. The inspection reports indicate that a rather serious seepage problem has existed at this dam since construction was completed.

D. Post Construction Changes

The downstream slope of the embankment was not seeded at the time of construction. Regrading and seeding was done in 1928. Due to lack of funds, the spillway chute was not constructed. The discharge was allowed to flow through the area excavated as a borrow pit. Erosion occurred and the existing chute was built in 1928. That same year, the single span bridge constructed over the spillway was replaced by a two-span structure with a pier built in the spillway. In 1934, the spillway crest was raised 2-inches during repairs to the spillway which were required as a result of the flood of August 1933.

In 1938, a large number of dry stone ditches were constructed below the toe of the dam to intercept seepage and spring water. The top section of the spillway chute was repaired in 1973.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of the Upper Owl Dam was good, although seepage appears to be a problem. Mr. Paul Behr of the Tamaqua Borough Authority accompanied the inspectors. The visual inspection check list is in Appendix A of this report. Photographs taken during the inspection are reproduced in Appendix E.

B. Embankment

The upstream slope of the embankment is protected by riprap and was in good condition. Some riprap had been displaced by ice action but at present this would not affect the integrity of the dam. The grassed breast of the dam was in good condition. The horizontal alignment was good and the width of the dam was regular and approximately 10 feet wide. The original drawing calls for a spillway weir at 5.0 feet below the top of the dam. The inspection survey indicates that the difference is, in general, less than 4.0 feet and at the low spot only 3.4 feet. Refer to Schematic Profile in Appendix A.

The downstream slope of the embankment had been recently cleared of brush and weeds. Trees close to the toe had been cut. The owner's representative stated that the cut trees would be removed in the near future.

The slope did not indicate any seepage, sloughing or erosion. Seepage was occurring at the toe on both sides of the valve house, but the quantity did not appear to be large. A toe drain is located to the right of the valve house. In the wooded area downstream from the embankment, about fifty feet from the toe, there is a small pool of water surrounded by a soft swampy condition. Water was observed bubbling from the bottom and near the center of this pool. Due to the location, it could not be determined what the approximate quantity of flow was. Several springs are present further downstream. These springs had been provided with downstream channels and it appears that measuring weirs had been used at one time. All water was clear and no deposits of fines were noticed.

C. Appurtenant Structures

The intake structure is a circular concrete tower, accessible by a footbridge from the breast of the dam. Some spalling of the concrete at the waterline had occurred due to normal weathering and ice action. The door leading to the inside was locked and no keys were available.

The representative of the owner stated that two of the five gates are in open position and that the gates in the tower had not been operated in at least 16 years. Two 20-inch pipes lead from the intake tower to the downstream valve house where the outflow to the downstream lake is controlled. The actual intake for the water supply is at a downstream reservoir. The valves on the 20-inch lines were operated during the inspection and are in good condition. Normally the water is released through a bypass line into an aeration system. The aeration system is installed on a wide asphalt paved discharge channel.

The spillway located in the right abutment has a triangular weir with unused grouting pipes projecting out. The approach to the spillway is well defined and free of obstructions. The abutments and upstream section of the discharge channel has been repaved with concrete, slightly reducing the efficiency of the spillway. A pier supporting a footbridge is located in the center of the weir. The discharge channel curves down and converges to a narrow channel (4 feet wide and 2.5 feet deep). Several cut down trees are straddling the channel, but will be removed. A large spillway discharge will certainly overtop the chute, but no damage to the embankment is expected.

D. Reservoir Area

The reservoir area is surrounded by woods and all the banks appear to be stable. Sedimentation has not been reported in the lake and no serious discoloration of water after heavy precipitation is reported.

E. Downstream Channel

The spillway discharge channel joins the original creek which has been partially lined with stone and concrete walls. Springs in this area are also directed to this creek, which enters the Lower Owl reservoir about 500 feet downstream of the dam under discussion. The water supply intake for the Borough is located at this lower reservoir. The Lower Owl Dam has a closed siphon spillway which could not be inspected due to the type of structure. An emergency spillway, consisting of a low section of the embankment is located near the left abutment of Lower Owl Dam. At the time of inspection, the pool level at Lower Owl Dam was at spillway elevation and about 3.4 feet below the top of the dam and only 1.4 feet below the emergency spillway. Failure of the Upper Owl Dam, due to overtopping, would cause failure of the Lower Owl Dam. The combined failure of these dams would increase the hazard to loss of life on Route 309 in this area and at an old factory located about 2.5 miles downstream from Upper Owl Dam near the junction of Owl Creek and Little Schuylkill River. The hazard category of the dam is considered "High".

3.2 EVALUATION

The general appearance of the Upper Owl Creek Dam was good, although the consistent seepage and the water bubbling out of the ground 50 feet beyond the toe gives reason for concern. The presence of several springs indicate that these springs could be fed through the dam foundation. The measuring of seepage by installing weirs and the study of seepage quantity with varying reservoir levels is deemed advisable.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURE

The dam is used as a water supply for the Borough of Tamaqua. If demand requires and the Lower Owl Reservoir level falls below a certain point, the bypass valves are opened and aerated water is released from the Upper Owl Creek Reservoir.

4.2 MAINTENANCE OF DAM

The embankment was in good condition and the slopes appeared to be stable. The growth had been recently cut down and trees close to the toe have been removed. The main concern is the seepage and the height of the dam compared to the spillway weir elevation.

4.3 MAINTENANCE OF OPERATING FACILITIES

The access to the intake structure was locked and it appears that the gates in this structure have not been operated for a long time. It is unknown and probably unlikely that the lower gate is open and that the opening of the valves downstream could draw down the reservoir in case of an emergency. The downstream valves were in good condition. The cut trees laying across the spillway chute and on the embankment slope should be removed.

4.4 WARNING SYSTEM

The facilities are visited on a daily basis during the week. There is, however, no formal surveillance and downstream warning system in effect.

4.5 EVALUATION

The recent cutting of weeds, brush and trees indicate that the owners are aware of good maintenance procedures of the embankment. It is strongly recommended that access to the tower be obtained and that the lower gate be operated at least twice a year to insure an operable condition in case of an emergency. Keys to open the lock should be kept in a safe and easily accessible location. A formal surveillance and downstream warning system should be a part of the operational procedures.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analyses available from PennDER for Upper Owl Creek Dam were not very extensive. No stage-storage curve, stage discharge curve, design storm hydrographs or routings were available.

B. Experience Data

In the period since the dam was completed in 1921, the maximum flood occurred in 1955. At that time the pool reached a level of about 1.4 feet higher than the spillway crest. This flood was passed without difficulty.

C. Visual Observations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event, until the dam is overtopped.

D. Overtopping Potential

Upper Owl Creek Dam has a total storage capacity of 1110 acre-feet at the present low point elevation of the dam and an overall height of 38 feet above streambed. These dimensions indicate a size classification of "Intermediate". The hazard classification is "High" (See Section 3.1.E).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is the Probable Maximum Flood (PMF). For this dam, the PMF peak inflow is 3290 cfs (see Appendix C for HEC-1 inflow computations).

Comparison of the estimated PMF peak inflow of 3290 cfs with the estimated spillway discharge capacity at Elevation 1096 of 1420 cfs indicates that a potential for overtopping of the Upper Owl Creek Dam exists.

An estimate of the storage effect of the reservoir and routing of the computed inflow hydrograph through the reservoir shows that this dam does not have the necessary storage available to pass the PMF without overtopping. The spillway-reservoir system can pass a flood event equal to 45% of a PMF at its present low elevation.

If the low area in the embankment would be raised to the intended design elevation, the spillway-reservoir system would be able to pass a flood event equal to 57% of a PMF.

E. Spillway Adequacy

The intermediate size category and high hazard category, in accordance with the Corps of Engineers criteria and guidelines, indicates that the Spillway Design Flood (SDF) for this dam should be the full Probable Maximum Flood (PMF).

The calculations show that the spillway discharge capacity and reservoir storage capacity combine to handle 47% of the (PMF) without overtopping the dam (refer to Sheet 8, of Appendix C). These calculations have considered the existing low point along the embankment crest.

Being an earth embankment dam, it is judged that a breach is likely to develop when the depth of flow over the crest is 0.5 foot or greater. These studies also indicate that the depth of flow over the crest of the embankment due to one-half PMF is less than 0.5 foot. On the basis of this information, it is judged that a one-half PMF will cause some overtopping of the embankment but not enough to cause a breach. Therefore, the spillway capacity is considered to be inadequate, but not seriously inadequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observation

1. Embankment

There were no visual indications of undue embankment stresses or sloughage and the slopes appear to be stable and dry. The toe of the downstream slope is wet and a considerable amount of seepage or springwater beyond the toe indicates that the cutoff trench is not completely effective. This seepage is clear and has existed for 55 years.

2. Appurtenant Structures

The intake structure and valve house are in reasonably good condition, although the inside of the intake structure could not be observed. There were no indications of unstable conditions. The spillway weir and top section of the spillway are in good condition. The stone lined spillway chute was in excellent condition, but appears to be too small.

B. Design and Construction Data

1. Embankment

Design data were not available for review. Available construction records indicate that the construction procedures were questionable during the first two years of construction. The construction of a 9-inch thick core wall, without details of joints, is questionable and it seems quite possible that cracks exist in the wall. The conduits, with concrete encasement, were placed before the cutoff trench was excavated. The encasement was not placed over a length of about 8 feet near the core wall. The core wall was placed around the pipes with a 2-inch asphalt ring for protection against potential uneven settlement. Cutoff walls were not placed along the encasement. No grouting of the fractured rock or clay foundation of the core wall was done. Seepage can be expected under these conditions. The slopes of the embankment are considered to be adequate for this type of construction. It appears that seepage will be a persistent problem.

2. Appurtenant Structures

The intake structure is not founded on rock. The foundation pressure, however, would be only about 2 kips per square

foot with an empty reservoir and less than that with a full reservoir. The structure appears to be adequately reinforced. The spillway weir was integral with the core wall and the sloping abutments are at present in good condition. The spillway chute is not sufficient for the size spillway. Erosion,due to overflow,would be away from the embankment and will not endanger the safety of the facilities.

C. Operating Records

There are no formal records of operation. However, inspection reports indicate a continuous seepage problem and damage to the spillway after floods.

D. Post Construction Changes

For a description of post construction changes reference is made to Section 2.4.D. These changes involved the collection of seepage (spring water) beyond the toe, repairs to the spillway walls and slab and construction of a pier for a footbridge over the spillway.

E. Seismic Stability

This dam is located in Seismic Zone No.1 and it is considered that the static stability is sufficient to withstand minor eqrthquake induced dynamic forces. However, no calculations, studies, etc., were made to confirm this conclusion.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection and the review of available design information, construction reports and operational records indicate that the Upper Owl Creek Dam is in fair condition. While there is no evidence of structural distress, the long term seepage condition beyond the downstream toe of the embankment is of concern. Regular observation and monitoring of this condition is deemed advisable in order to assure the continued satisfactory operation of this dam.

The results of the hydrologic and hydraulic investigations, in accordance with the Corps of Engineers' evaluation guidelines, indicates that the spillway discharge and reservoir storage have the capacity for passing 45 percent of the PMF without overtopping the dam. The calculations show, however, that the depth of the overtopping caused by one-half PMF is less than that judged to cause failure (0.5 feet) (see Section 5.1.E). On the basis of this information, the spillway for this facility is considered to be inadequate but not seriously inadequate.

The inspection survey shows an uneven profile of the embankment crest. Refer to Plate A-I in Appendix A. While this condition does not affect the stability of the embankment, providing an uniform elevation at the design crest level will improve the overall capacity of the facility.

B. Adequacy of Information

The information available for review is considered to be sufficiently adequate for making a reasonable assessment of this project.

C. Urgency

It is suggested that the recommendations presented in this report be implemented without delay.

D. Necessity for Additional Studies

The steady seepage condition beyond the toe of the embankment is of concern and should be studied in detail to determine the seriousness of the condition relating to the future performance of the dam.

7.2 RECOMMENDATIONS

A. Facilities

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for consideration by the owner:

1. The top of the dam should be raised uniformly to its intended design height.

2. Access into the intake tower should be provided.

3. The condition of the upstream drawdown gate should be closely examined by a qualified professional engineer.

4. The seepage condition beyond the toe of the embankmnt should be evaluted by a qualified professional engineer. If remedial measures are necessary, they should be carried out by the owner.

5. The downstream embankment slope and the spillway discharge channel should be cleared of brush and trees.

B. Operation and Maintenance Procedures

It is recommended that the following procedures be scheduled by the owner:

1. Schedule regular maintenance of the embankment crest and slopes on an annual basis.

2. Carry out a semi-annual operation and maintenance of the drawdown sluice gate in the intake tower and the blowoff valves in the valve house.

3. Develop and implement a formal surveillance and downstream warning system to be used during periods of high or prolonged precipitation.

APPENDIX A

CHECKLIST OF VISUAL INSPECTION REPORT

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 54-96 NDI NO. PA-00 673

NAME OF DAM Upper Owl Creek HAZARD CATEGORY High

TYPE OF DAM Earthfill with Concrete Core

LOCATION Rahn TOWNSHIP Schuylkill COUNTY, PENNSYLVANIA

INSPECTION DATE 10/26/78 WEATHER Cloudy TEMPERATURE 50's

INSPECTORS: H. Jongsma (Recorder) OWNER'S REPRESENTATIVE(s):

A. Bartlett Paul Behr

R. Shireman

NORMAL POOL ELEVATION: 1092 (U.S.G.S.) AT TIME OF INSPECTION:

BREAST ELEVATION: 1096 POOL ELEVATION: 1089.6

SPILLWAY ELEVATION: 1092 (U.S.G.S.) TAILWATER ELEVATION: 1058

MAXIMUM RECORDED POOL ELEVATION: 1093.4±

GENERAL COMMENTS:

Immediately downstream is the Lower Owl Creek Dam which has a closed spillway and a syphon in the right abutment. An emergency spillway on Lower Owl Dam is located in the left abutment with the discharge running parallel to the toe of the embankment. The emergency spillway is 1.4 feet above normal pool and top of dam is 3.4 feet above normal pool. If Upper Owl Creek Dam fails, Lower Owl Creek would also fail.

NDI NO. PA-00 673

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None evident.
B. UNUSUAL MOVEMENT BEYOND TOE	None.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	Some riprap displaced at upstream by ice. Downstream slope good.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	 Good. Good, except left abutment which has a low spot.
E. RIPRAP FAILURES	Some ice damage.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	 Good. Good.
G. SEEPAGE	On both sides of valve house. Not serious in quantity. Large swampy area about 30 feet downstream from valve house. About 50' downstream water bubbling out of ground. Not measurable. Several other springs farther downstream.
H. DRAINS	Toe drain north of valve house.
J. GAGES & RECORDER	None.
K. COVER (GROWTH)	Upstream; Riprap. Breast: Grass. Downstream: Weeds, cut brush and cut down trees.

NDI NO. PA-00 673

VISUAL INSPECTION
OUTLET WORKS

	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Concrete circular tower with locked door. Key not available. Some deterioration at pool level.
B. OUTLET STRUCTURE	Concrete square building - good condition.
C. OUTLET CHANNEL	Asphalt paved wide channel with aeration piping. Narrows down to paved stream and leads to Lower Owl Reservoir.
D. GATES	Five gates on intake structure. Not checked due to locked door. Some gates are open. Control by valves in downstream valve house.
E. EMERGENCY GATE	Low Gate. Gates in intake tower have not been used in at least 16 years.
F. OPERATION & CONTROL	All operation and control on downstream side.
G. BRIDGE (ACCESS)	Truss bridge from dam crest.

NDI NO. PA-00 673

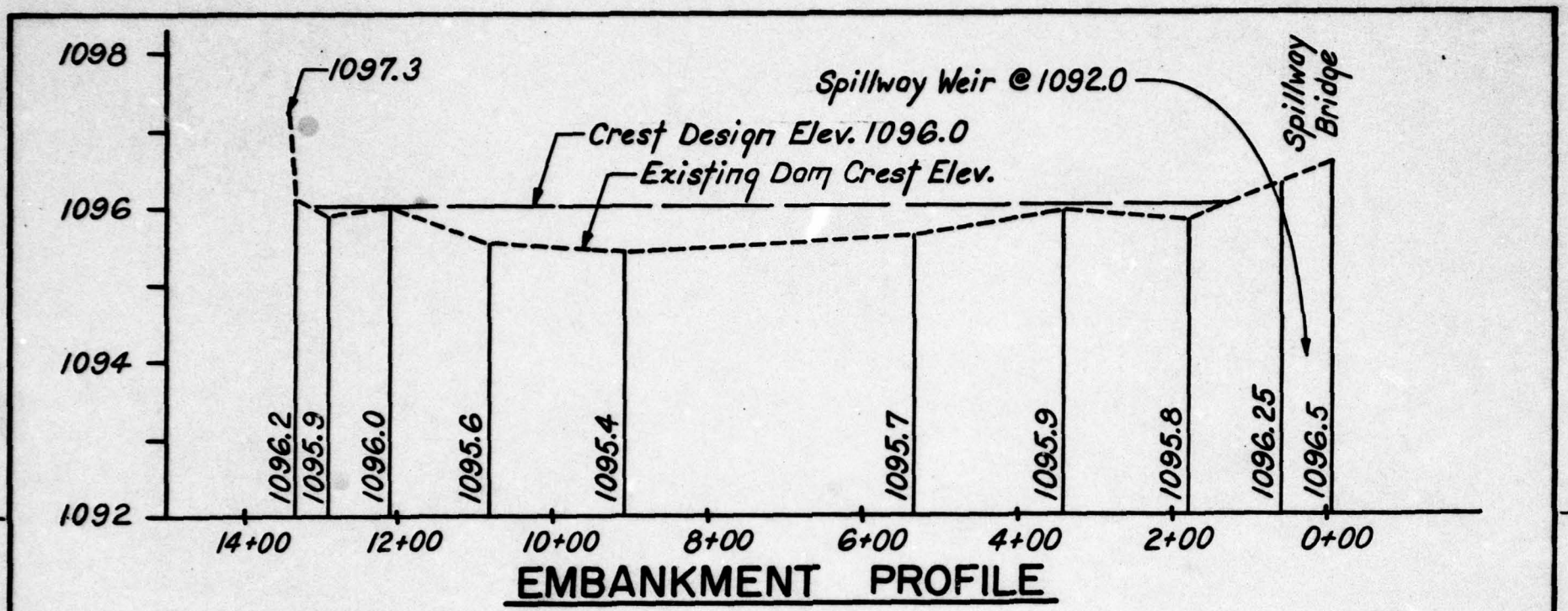
VISUAL INSPECTION
SPILLWAY

	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Well defined. No obstruction. Approach sloping up to 6 inches below weir.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	 Good - grout pipes projecting above weir. None. None. Not visible. Sloping riprap with deteriorated cement facing.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	Top part new concrete slab and sloping walls, good condition. Narrows down to narrow stone chute (2'6" deep, 4' wide). No stilling basin.
D. BRIDGE & PIERS	Footbridge with 2'6" wide pier. 3'11" vertical clearance over weir.
E. GATES & OPERATION EQUIPMENT	None.
F. CONTROL & HISTORY	Upstream section repaired in 1973. Drawings dated 1970. New lining reducing spillway efficiency (12" on each side). Maximum recalled flow 16 to 18 inches in 1955.

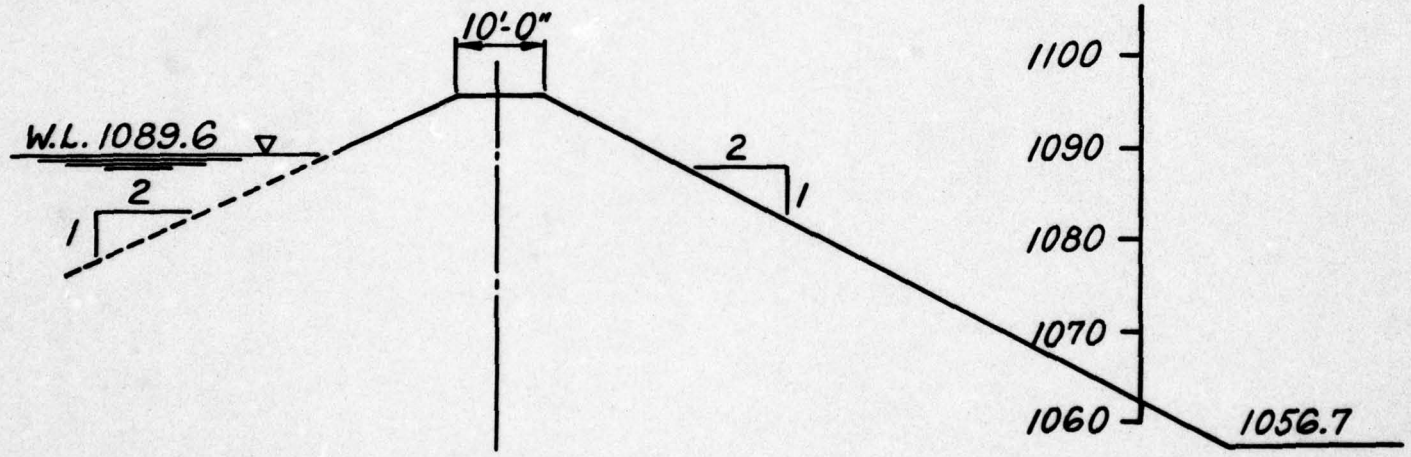
NDI NO. PA-00 673

VISUAL INSPECTION

	OBSERVATIONS AND REMARKS
INSTRUMENTATION Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	None.
Other	
RESERVOIR Slopes	Wooded slopes.
Sedimentation	None reported.
Watershed Description	Forested.
DOWNSTREAM CHANNEL Condition	Lower Owl Reservoir with closed spillway and emergency spillway.
Slopes	Reservoir banks.
Approximate Population	None till junction with Little Schuylkill River.
No. Homes	Factory at Route 309.



EMBANKMENT PROFILE

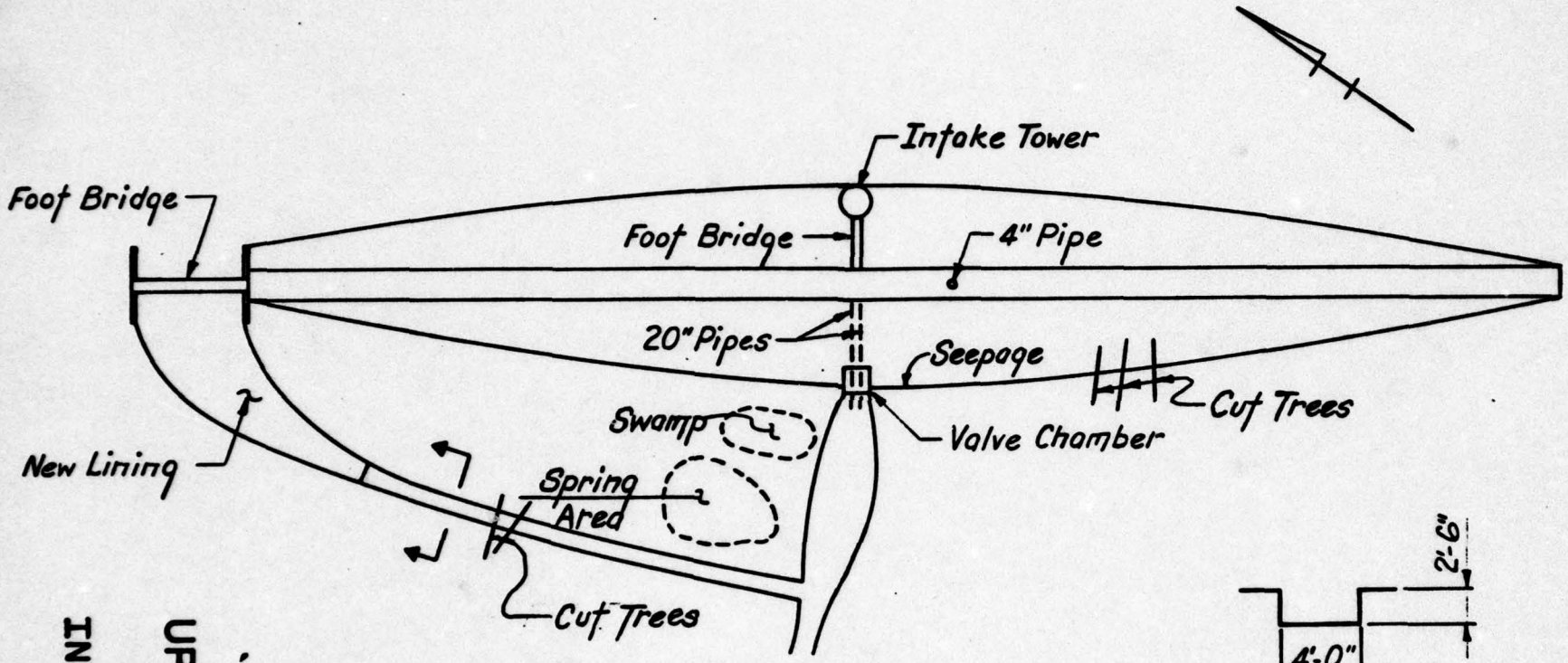


EMBANKMENT SECTION

Surveyed 10/26/78

UPPER OWL CREEK
DAM PA.673
INSPECTION SURVEY

PLATE A-I



SECTION

PLAN

UPPER OWL CREEK DAM

UPPER OWL CREEK
DAM PA. 673
INSPECTION SURVEY

PLATE A-II

Surveyed 10/26/78

APPENDIX B

CHECKLIST OF ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

PA DER # 54-96 NDI NO. PA-00 673

NAME OF DAM UPPER OWL CREEK DAM

ITEM	REMARKS
AS-BUILT DRAWINGS	None
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle See Plate II, Appendix F
CONSTRUCTION HISTORY	Construction started in 1919 by B.G.Coon Construction Company. In 1920 construction was taken over by the Borough under force account. Construction completed in 1921 by Central Construction Company, Harrisburg, Pa.
GENERAL PLAN OF DAM	In DER file and redrawn for this report, Plate III, Appendix F.
TYPICAL SECTIONS OF DAM	Appendix F, Plate IV
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	Appendix F, Plate IV None.

NDI NO. PA-00 673

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	None, except one hydrograph for a rainfall on July 19, 1921 in DER file. However, letter indicates that this was not very accurate.
DESIGN REPORTS	None, except PennDER Report on application for permit to construction dam.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	None.
POST CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	One located at the left end of the dam consisting of yellow clay and many big boulders. One located downstream at the right side, where spillway discharge channel is located.

NDI NO. PA-00 673

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	Weirs installed around 1923 and probably only used for 1 or 2 years.
MODIFICATIONS	Spillway and spillway bridge reconstructed. Spillway discharge channel changed from V to U-shape. Drains below the toe installed.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	None.
SPILLWAY PLAN, SECTIONS AND DETAILS	Appendix F, Plate IV.

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	Appendix F, Plate IV
CONSTRUCTION RECORDS	Many inspection reports by PennDER and some photographs.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	Inspection reports by DER. Some settlements of breast of dam.
MISCELLANEOUS	Construction progress was slow during 1919 and 1920 and often unsatisfactory due to large boulders and not very good compaction. Grout pipes were placed in the 9-inch core wall for future grouting. Records do not indicate that grouting was done.

NDI NO. PA-00 673

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Mostly wooded and mountains

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 1092; 860 Acre-Feet

TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev.1096;1160Acre-Feet

MAXIMUM DESIGN POOL: Elev. 1096

TOP DAM: Elev. 1096

SPILLWAY:

a. Elevation 1092

b. Type Uncontrolled triangular.

c. Width Variable trapezoidal (48.5 feet at base)

d. Length

e. Location Spillover Right abutment.

f. Number and Type of Gates None.

OUTLET WORKS:

a. Type Intake tower with gates at 5 levels.

b. Location Upstream toe.

c. Entrance inverts 1059.5

d. Exit inverts 1058.5

e. Emergency drawdown facilities 18" gate in intake tower.

HYDROMETEOROLOGICAL GAGES:

a. Type None.

b. Location None.

c. Records None.

MAXIMUM NON-DAMAGING DISCHARGE: 1,700 cfs.

APPENDIX C

HYDROLOGY AND HYDRAULIC CALCULATIONS

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge, time of the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

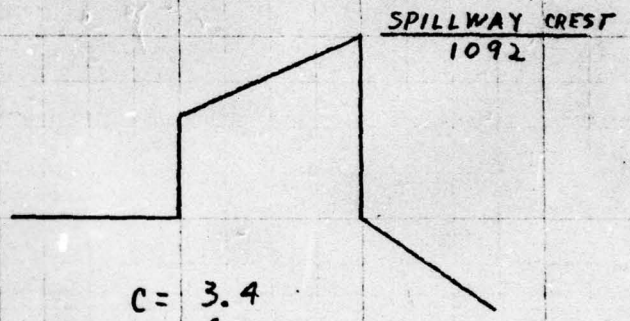
The results of the studies conducted for this report are presented in Section 5.

For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California.

BY RLS DATE 12/5/78 BERGER ASSOCIATES SHEET NO. 1 OF
CHKD. BY PJB DATE 12/27/78 PROJECT D8490
SUBJECT UPPER OWL CREEK DAM

MAXIMUM KNOWN FLOOD AT DAMSITE

THE MAXIMUM KNOWN FLOOD AT UPPER OWL CREEK DAM OCCURRED IN 1955. AT THAT TIME THE WATER LEVEL IN THE POOL REACHED AN ELEVATION ABOUT 1.4' HIGHER THAN THE SPILLWAY CREST.

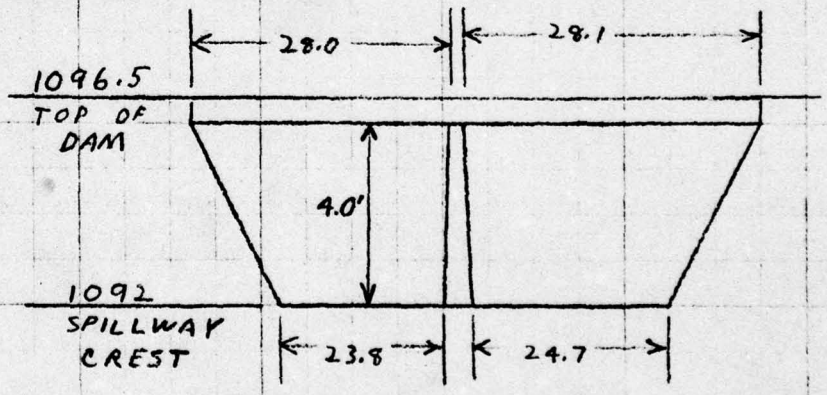


C = 3.4
(ESTIMATED FROM KING'S HDBK.)

C = 3.4
H = 1.4
L_T = 28 + 28.1 = 56.1
L_B = 23.8 + 24.7 = 48.6

$L = 48.5 + ((56.1 - 48.5)\frac{1.4}{4} \times .5)$

= 49.8'



$Q = CLH^{3/2}$

$= 3.4 \times 49.8 \times (1.4)^{1.5}$

= 280 CFS

SPILLWAY CAPACITY

C = 3.4
H = 4

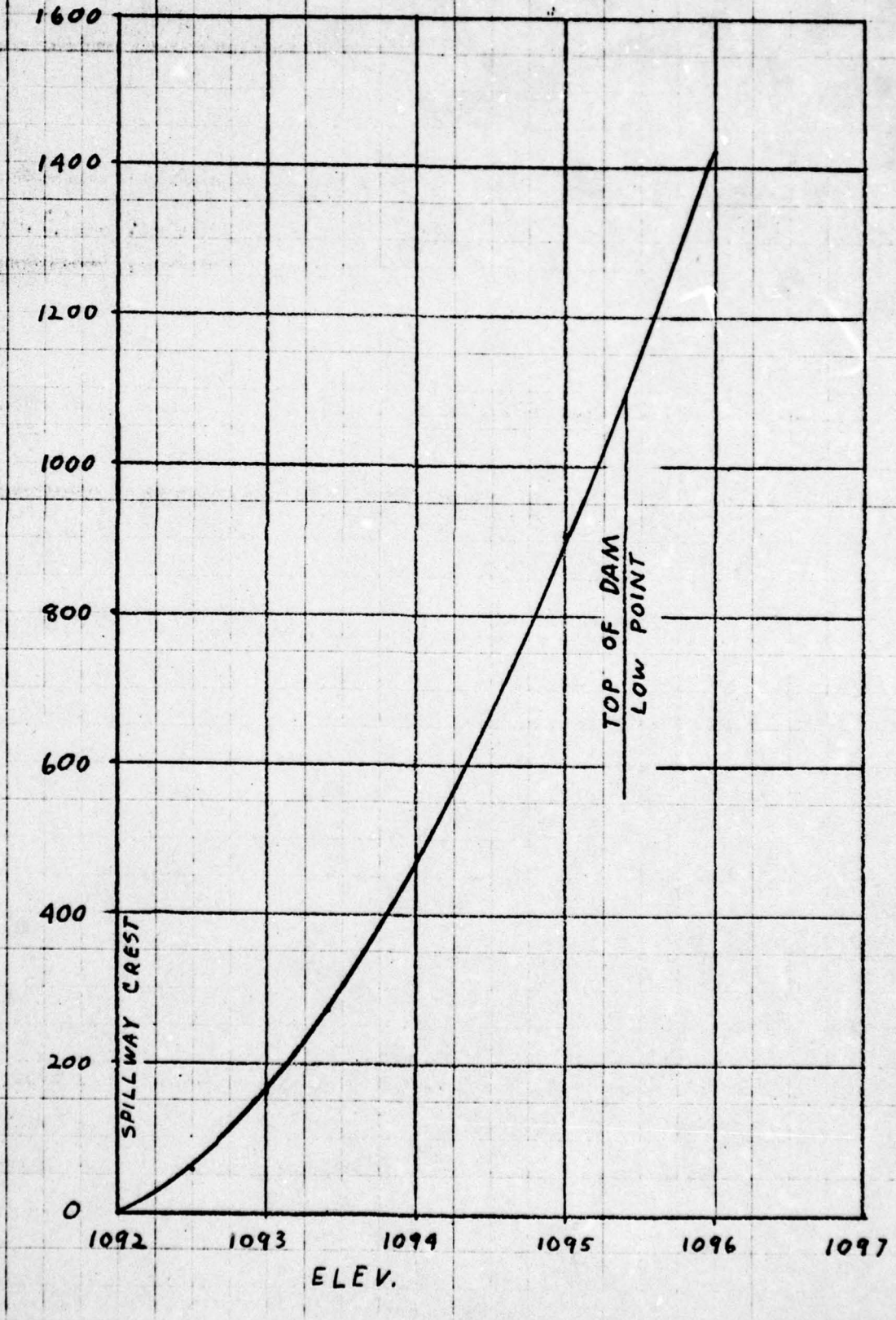
L = (48.5 + 56.1)/2 = 52.3'

$Q = CLH^{3/2} = 3.4 \times 52.3 \times 4^{1.5}$

= 1423 CFS SAY 1420 CFS

BY RLS DATE 12/6/78 **BERGER ASSOCIATES** SHEET NO. 2 OF
CHKD. BY DJR DATE 12/27/78 PROJECT D8490
SUBJECT UPPER OWL CREEK DAM

SPILLWAY RATING CURVE



BY RLS DATE 12/6/78 BERGER ASSOCIATES SHEET NO. 3 OF
CHKD. BY DJR DATE 12/27/78 PROJECT D8490
SUBJECT UPPER OWL CREEK DAM

DISCHARGE THROUGH OUTLET WORKS

2 - 20" PIPES

ELEV. = 1061
TAILWATER = 1061

A = 2.18

C = 0.6

FOR POOL LEVEL = 1092

$H = 1092 - 1061 = 31$

$Q = CA\sqrt{2gH}$

$= .6 \times 2.18 \times (2 \times 32.2 \times 31)^{.5}$

$= 58$ CFS $\times 2 = 116$ CFS

FOR POOL LEVEL = 1070

$H = 1070 - 1061 = 9$

$Q = CA\sqrt{2gH}$

$= .6 \times 2.18 \times (2 \times 32.2 \times 9)^{.5}$

$= 31$ CFS $\times 2 = 62$ CFS

BY RLS DATE 1/19/77 | BERGER ASSOCIATES | SHEET NO. 4 OF
CHKD. BY DATE | PROJECT D8490
SUBJECT UPPER OWL CREEK DAM

EMBANKMENT RATING

1095.6

$2.7 \times 348 \times .1^{3/2} = 30$

1095.7

$2.7 \times 34 \times .05^{3/2} = 1$

$2.7 \times 348 \times .2^{3/2} = 89$

$2.7 \times 195 \times .05^{3/2} = 6$ $\quad \Sigma = 91$

1095.9

$2.7 \times 68 \times .1^{3/2} = 6$

$2.7 \times 34 \times .25^{3/2} = 11$

$2.7 \times 348 \times .4^{3/2} = 238$

$2.7 \times 195 \times .25^{3/2} = 66$

$2.7 \times 185 \times .1^{3/2} = 16$

$2.7 \times 24 \times .05^{3/2} = 1$ $\quad \Sigma = 338$

1096

$2.7 \times 129 \times .05^{3/2} = 4$

$2.7 \times 68 \times .2^{3/2} = 16$

$2.7 \times 34 \times .35^{3/2} = 19$

$2.7 \times 348 \times .5^{3/2} = 332$

$2.7 \times 195 \times .35^{3/2} = 109$

$2.7 \times 185 \times .25^{3/2} = 62$

$2.7 \times 24 \times .15^{3/2} = 4$

$2.7 \times 24 \times .05^{3/2} = 1$ $\quad \Sigma = 547$

1096.2

$2.7 \times (129+24) \times .25^{3/2} = 52$

$2.7 \times 68 \times .4^{3/2} = 46$

$2.7 \times (34+195) \times .55^{3/2} = 252$

$2.7 \times 348 \times .7^{3/2} = 550$

$2.7 \times 185 \times .45^{3/2} = 151$

$2.7 \times 24 \times .35^{3/2} = 13$

$2.7 \times 87 \times .1^{3/2} = 7$ $\quad \Sigma = 1071$

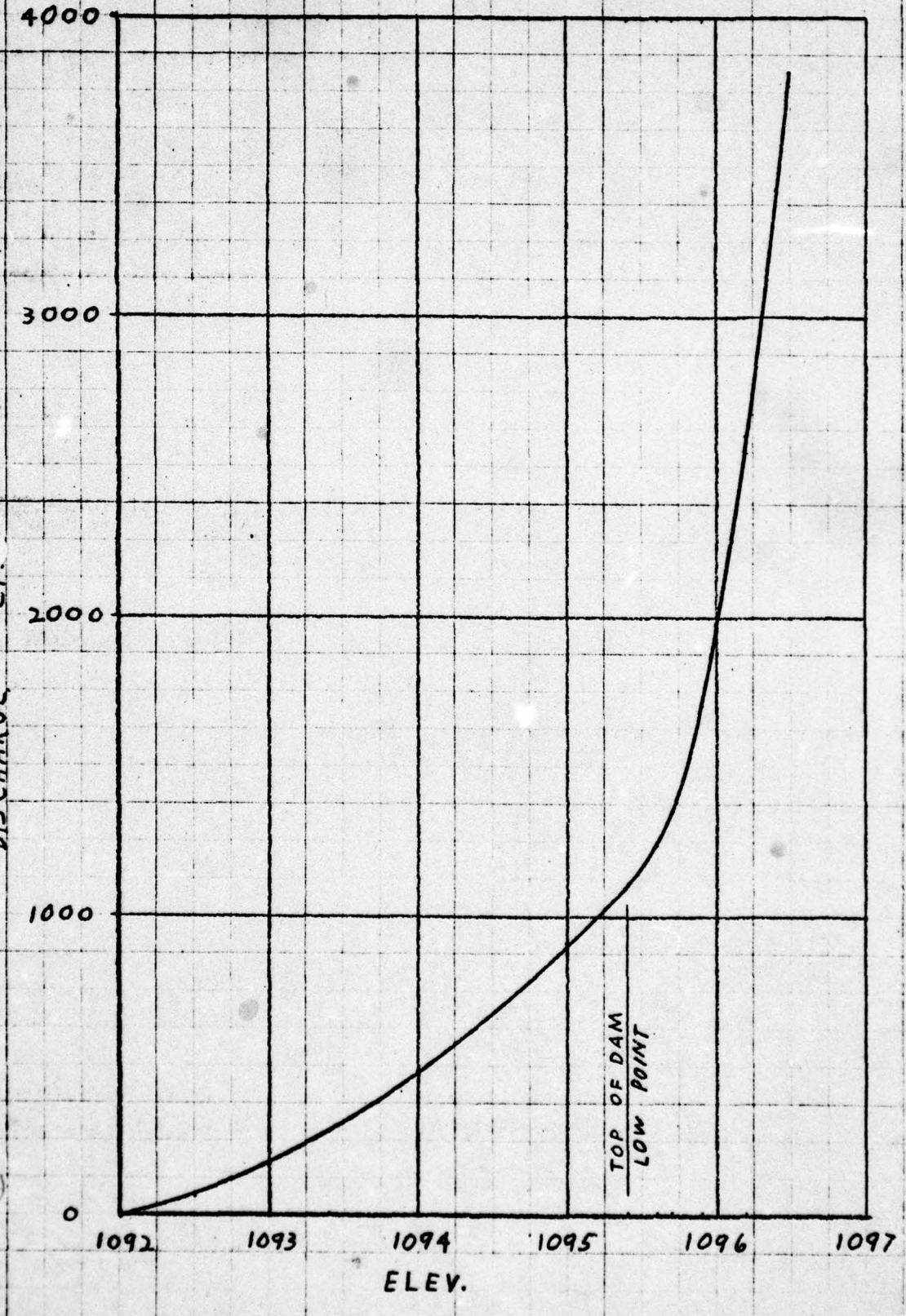
1096.5 $\quad \Sigma = 2118$

BY RLS DATE 1/11/79 **BERGER ASSOCIATES** SHEET NO. 5 OF

CHKD. BY DATE PROJECT D8490

SUBJECT UPPER OWL CREEK DAM

DISCHARGE RATING CURVE
SPILLWAY AND EMBANKMENT



BY RLS DATE 12/28/78 | BERGER ASSOCIATES | SHEET NO. 6 OF
CHKD. BY DATE | PROJECT D 8490
SUBJECT UPPER OWL CREEK DAM

SIZE CLASSIFICATION

MAXIMUM STORAGE = 1109 ACRE-FEET
MAXIMUM HEIGHT = 38 FEET
SIZE CLASSIFICATION IS INTERMEDIATE.

HAZARD CLASSIFICATION

THE LOWER OWL CREEK DAM LIES IMMEDIATELY DOWNSTREAM
USE "HIGH".

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO THE PROBABLE MAXIMUM FLOOD.

BY RLS DATE 1/31/79 | BERGER ASSOCIATES | SHEET NO. 7 OF
CHKD. BY DATE | PROJECT D8490
SUBJECT UPPER OWL CREEK DAM

HEC-1 DATA

DRAINAGE AREA = 1.5 SQ. MI.

DELAWARE BASIN REGION 6

CP = 0.40

LONGEST WATER COURSE = 9000' = 1.7 mi.

L TO CENTROID = 4900' = 0.93 mi.

$$T_P = 1.35 (L \times L_{CA})^{.3}$$

$$T_P = 1.55$$

RAINFALL (HMR-33)

INDEX = 22.6"

ZONE 6

INCREMENTAL RAINFALL

6 HR	= 113 %
12 HR	= 123 %
24 HR	= 132 %
48 HR	= 142 %

PLANIMETERED AREAS (FROM QUAD SHEETS)

ELEV.: 1092	=	66.8 ACRES
1100	=	99.8 ACRES
1120	=	184 ACRES

ZERO STORAGE ELEVATION

ELEV = 1092 - (STORAGE x 3/AREA)

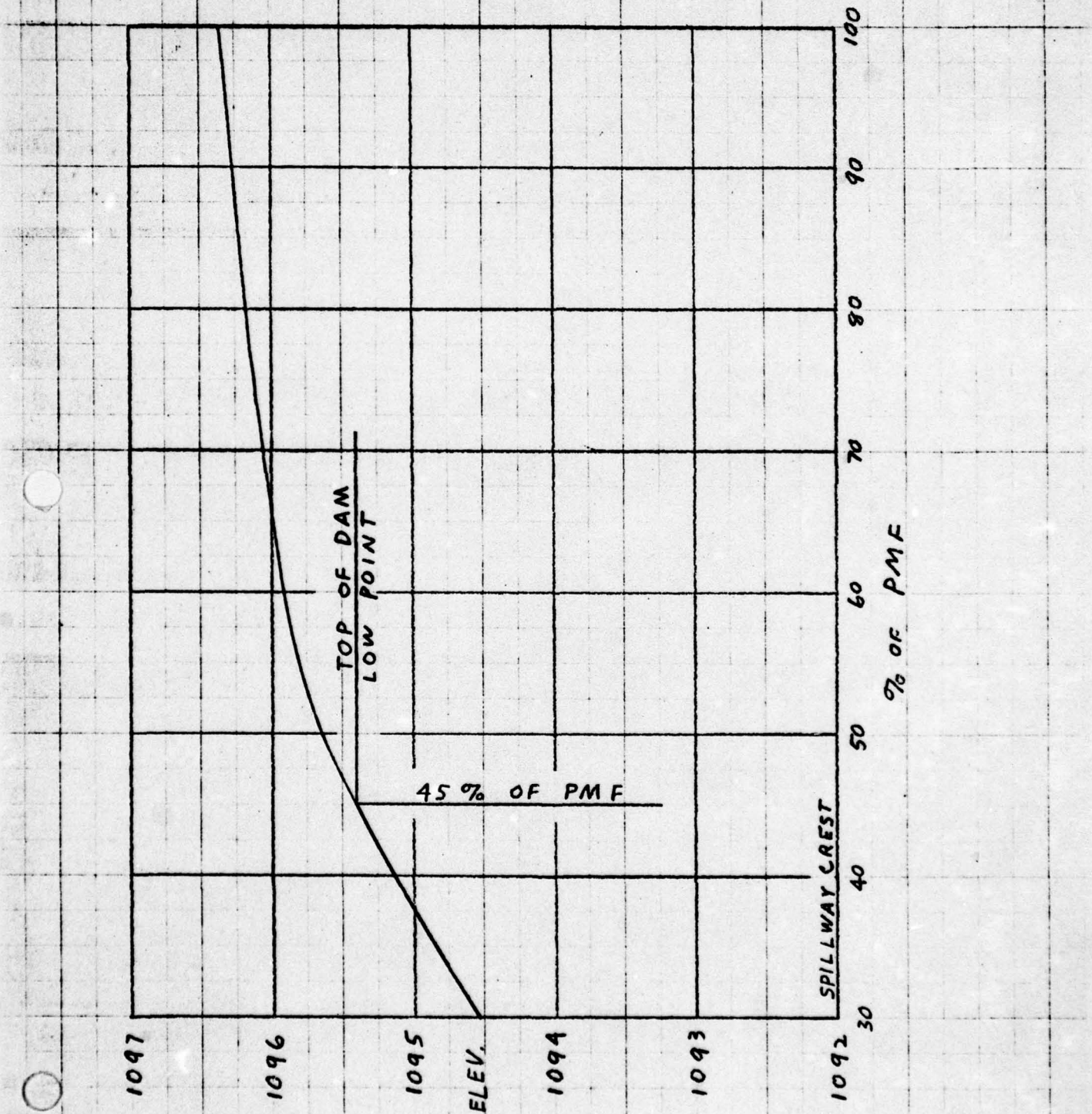
ELEV = 1053.4

BY RLS DATE 1/11/79 **BERGER ASSOCIATES** SHEET NO. 8 OF

CHKD. BY DATE PROJECT D8490

SUBJECT UPPER OWL CREEK DAM

SPILLWAY RATING CURVE

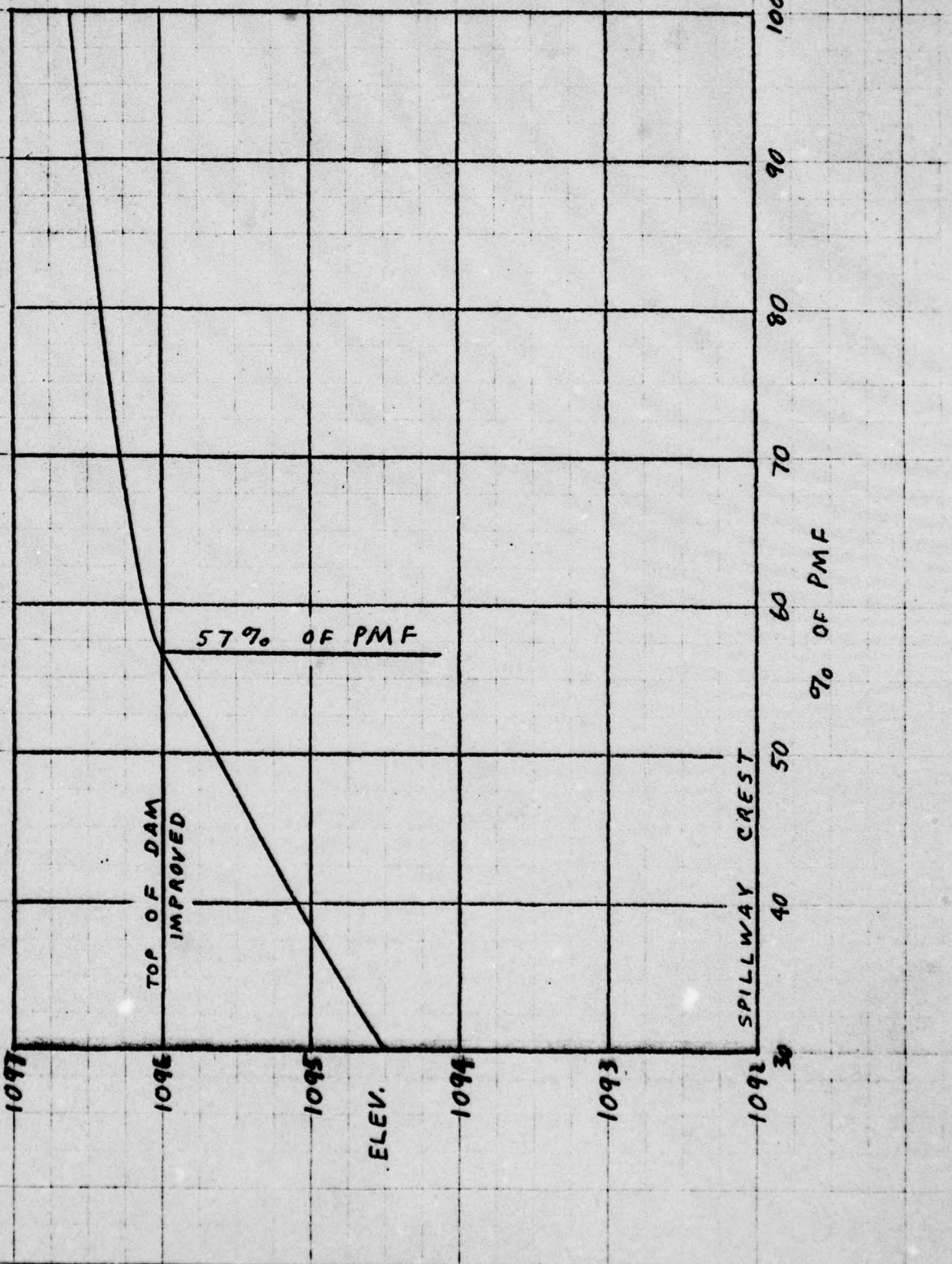


BY RLS DATE 2/15/79 | BERGER ASSOCIATES | SHEET NO. 9 OF

CHKD. BY DATE | PROJECT D8490

SUBJECT UPPER OWL CREEK DAM

SPILLWAY CAPACITY CURVE
IMPROVED EMBANKMENT



```
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
 LAST MODIFICATION  21 AUG 78
**********************************

     1          A1   UPPER OWL CREEK DAM  ****  OWL CREEK
     2          A2   RAHN TWP., SCHUYLKILL COUNTY, PA.
     3          A3   NDI # PA-00673    PA DER # 54-96
     4          B  300    0   15    0    0    0    0    0   -4    0
     5          B1   5
     6          J    1    9    1
     7          J1   1   .9   .8   .7   .6   .5   .4   .3  .15
     8          K        1                             1
     9          K1            INFLOW HYDROGRAPH
    10          M    1    1  1.5
    11          P         22.6  113  123  132  142
    12          T                                   1  .05
    13          W 1.55   .4
    14          X -1.5 -.05    2
    15          K    1    2                        1
    16          K1            RESERVOIR ROUTING
    17          Y                        1    0
    18          Y1   1                                859   -1
    19          Y4 1092 1092.5 1093 1093.4 1094 1095 1095.4 1095.6 1095.7 1095.9
    20          Y4 1096 1096.2 1096.5
    21          Y5   0   59  168  280  485  907 1102 1236 1350 1705
    22          Y5 1970 2607 3815
    23          $A   0 66.8 99.8  184
    24          $E1053.4 1092 1100 1120
    25          $$ 1092
    26          $D1095.4
    27          K   99

1                    PREVIEW OF SEQUENCE OF STREAN NETWORK CALCULATIONS

                          RUNOFF HYDROGRAPH AT        1
                          ROUTE HYDROGRAPH TO         2
                          END OF NETWORK

1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION  JULY 1978
  LAST MODIFICATION  21 AUG 78
 **********************************

 RUN  DATE# 79/02/13.
      TIME# 13.46.06.

                    UPPER OWL CREEK DAM  ****  OWL CREEK
                    RAHN TWP., SCHUYLKILL COUNTY, PA.
                    NDI # PA-00673    PA DER # 54-96

                                JOB SPECIFICATION
                    NQ    NHR   NMIN   IDAY    IHR   IMIN  METRC   IPLT   IPRT  NSTAN
                   300      0     15      0      0      0      0      0     -4      0
                                      JOPER    NWT  LROPT  TRACE
                                         5      0      0      0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                    NPLAN=  1  LRTIO=  1
```

UPPER OWL CREEK DAM **** OWL CREEK
RAHN TWP., SCHUYLKILL COUNTY, PA.
NDI # PA-00673 PA DER # 54-96

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED

NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS= 1.00 .90 .80 .70 .60 .50 .40 .30 .15

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.50	0.00	1.50	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.60	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.55 CP= .40 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 65 END-OF-PERIOD ORDINATES, LAG= 1.56 HOURS, CP= .40 VOL= 1.00

13.	50.	103.	161.	212.	244.	250.	235.	215.	198.
181.	166.	152.	140.	128.	118.	108.	99.	91.	83.
76.	70.	64.	59.	54.	50.	45.	42.	38.	35.
32.	30.	27.	25.	23.	21.	19.	18.	16.	15.
14.	12.	11.	10.	10.	9.	8.	7.	7.	6.
6.	5.	5.	4.	4.	4.	3.	3.	3.	3.
2.	2.	2.	2.	2.					

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP

SUM	25.67	23.28	2.40
	(652.)	(591.)	(61.)

9053
(2563.)

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	859.	-1

STAGE	1092.0	1092.5	1093.0	1093.4	1094.0	1095.0	1095.4	1095.6	1095.7	1095.
	1096.0	1096.2	1096.5							
FLOW	0.	59.	168.	280.	485.	907.	1102.	1236.	1350.	1705.
	1970.	2607.	3815.							
SURFACE AREA=	0.	67.	100.	184.						
CAPACITY=	0.	859.	1521.	4317.						
ELEVATION=	1053.	1092.	1100.	1120.						

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1092.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1095.4	0.0	0.0	0.

PEAK OUTFLOW IS 3221. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 2894. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 2509. AT TIME 42.00 HOURS

PEAK OUTFLOW IS 2141. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 1721. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 1283. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 968. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 708. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 316. AT TIME 43.75 HOURS

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				RATIOS APPLIED TO FLOWS								
				1.00	.90	.80	.70	.60	.50	.40	.30	.15
HYDROGRAPH AT	1	1.50	1	3292.	2963.	2633.	2304.	1975.	1646.	1317.	988.	494.
		(3.88)	(	93.21)(	83.89)(	74.57)(	65.25)(	55.93)(	46.61)(	37.28)(	27.96)(	13.98)
ROUTED TO	2	1.50	1	3221.	2894.	2509.	2141.	1721.	1283.	963.	708.	316.
		(3.88)	(	91.20)(	81.95)(	71.06)(	60.64)(	48.74)(	36.32)(	27.42)(	20.05)(	8.96)

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	1091.98	1092.00	1095.40
	STORAGE	858.	859.	1109.
	OUTFLOW	0.	0.	1102.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1096.34	.94	1186.	3221.	6.50	41.75	0.00
.90	1096.25	.85	1178.	2894.	6.25	41.75	0.00
.80	1096.17	.77	1172.	2509.	5.50	42.00	0.00
.70	1096.05	.65	1162.	2141.	4.75	42.25	0.00
.60	1095.91	.51	1150.	1721.	3.75	42.75	0.00
.50	1095.64	.24	1128.	1283.	2.50	43.25	0.00
.40	1095.13	0.00	1087.	968.	0.00	43.50	0.00
.30	1094.53	0.00	1041.	708.	0.00	43.50	0.00
.15	1093.51	0.00	964.	316.	0.00	43.75	0.00

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 21 AUG 78
****
EOI ENCOUNTERED.
N>Z

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 21 AUG 78
****

```
1     A1    UPPER OWL CREEK DAM ****  OWL CREEK
2     A2    RAHN TWP., SCHUYLKILL COUNTY, PA.
3     A3,   NDI # PA-00673 , PA DER # 54-96 ,
4     B  300    0   15    0    0    0    0    0   -4    0
5     B1   5
6     J    1    9    1
7     J1   1   .9   .8   .7   .6   .5   .4   .3  .15
8     K         1                             1
9     K1              INFLOW HYDROGRAPH
10    M    1    1  1.5
11    P         22.6  113  123  132  142
12    T                                       1  .05
13    W  1.55   .4
14    X -1.5  -.05    2
15    K    1    2                             1
16    K1              RESERVOIR ROUTING - (FILL LOW SPOTS TO DESIGN CREST EL.)
17    Y                             1    0
18    Y1   1                                  859   -1
19    Y4 1092 1093 1094 1095 1096 1096.5 1097
20    Y5   0  168  485  907 1423 1697 1988
21    $A   0 66.8 99.8  184
22    $E1053.4 1092 1100 1120
23    $$ 1092
24    $D 1096  2.7  1.5 1200
25    K   99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 1
ROUTE HYDROGRAPH TO 2
END OF NETWORK

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 21 AUG 78
****

RUN DATE# 79/02/14.
TIME# 10.06.11.

UPPER OWL CREEK DAM **** OWL CREEK
RAHN TWP., SCHUYLKILL COUNTY, PA.
NDI # PA-00673 PA DER # 54-96

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS= 1.00 .90 .80 .70 .60 .50 .40 .30 .15

UPPER OWL CREEK DAM *** OWL CREEK
RAHN TWP., SCHUYLKILL COUNTY, PA.
NDI # PA-00673 PA DER # 54-96

I
2/4

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS= 1.00 .90 .80 .70 .60 .50 .40 .30 .15

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.50	0.00	1.50	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.60	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.55 CP= .40 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 65 END-OF-PERIOD ORDINATES, LAG= 1.56 HOURS, CP= .40 VOL= 1.00

13.	50.	103.	161.	212.	244.	250.	235.	215.	198.
181.	166.	152.	140.	128.	118.	108.	99.	91.	83.
76.	70.	64.	59.	54.	50.	45.	42.	38.	35.
32.	30.	27.	25.	23.	21.	19.	18.	16.	15.
14.	12.	11.	10.	10.	9.	8.	7.	7.	6.
6.	5.	5.	4.	4.	4.	3.	3.	3.	3.
2.	2.	2.	2.	2.					

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	25.67	23.28	2.40	90532.
										(652.)	(591.)	(61.)	(2563.5

HYDROGRAPH ROUTING

RESERVOIR ROUTING - (FILL LOW SPOTS TO DE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	859.	-1

STAGE	1092.0	1093.0	1094.0	1095.0	1096.0	1096.5	1097.0
FLOW	0.	168.	485.	907.	1423.	1697.	1988.
SURFACE AREA=	0.	67.	100.	184.			
CAPACITY=	0.	859.	1521.	4317.			
ELEVATION=	1053.	1092.	1100.	1120.			

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1092.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1096.0	2.7	1.5	1200.

PEAK OUTFLOW IS 3212. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 2854. AT TIME 42.00 HOURS

PEAK OUTFLOW IS 2473. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 2078. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 1603. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 1242. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 965. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 701. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 315. AT TIME 43.75 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .60	RATIO 6 .50	RATIO 7 .40	RATIO 8 .30	RATIO 9 .15
HYDROGRAPH AT	1	1.50	1	3292.	2963.	2633.	2304.	1975.	1646.	1317.	988.	494.
	(	3.88)	(	93.21)(	83.89)(	74.57)(	65.25)(	55.93)(	46.61)(	37.28)(	27.96)(	13.98)
ROUTED TO	2	1.50	1	3212.	2854.	2473.	2078.	1603.	1242.	965.	701.	315.
	(	3.88)	(	90.95)(	80.80)(	70.03)(	58.83)(	45.39)(	35.17)(	27.32)(	19.84)(	8.91)

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1091.98	1092.00	1096.00
STORAGE	858.	859.	1157.
OUTFLOW	0.	0.	1423.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1096.59	.59	1207.	3212.	5.00	41.75	0.00
.90	1096.50	.50	1199.	2854.	4.50	42.00	0.00
.80	1096.40	.40	1191.	2473.	3.75	42.25	0.00
.70	1096.29	.29	1181.	2078.	2.75	42.50	0.00
.60	1096.11	.11	1167.	1603.	1.50	43.00	0.00
.50	1095.65	0.00	1129.	1242.	0.00	43.25	0.00
.40	1095.11	0.00	1086.	965.	0.00	43.50	0.00
.30	1094.51	0.00	1039.	701.	0.00	43.50	0.00
.15	1093.46	0.00	961.	315.	0.00	43.75	0.00

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 21 AUG 78
****
EOI ENCOUNTERED.
N>BYE

JOB PROCESSING CCUS 2.330
BYE 79/02/15. 05.32.45.

APPENDIX D

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Middle Member of the Mauch Chunk Formation.

Lithology: Grayish red and reddish brown sandstone interbedded with similarly colored siltstone, mudstone and shale. Some thin interbeds of green to grayish green mudstones are common.

Structure

The Owl Creek valley is located on the south side of the Minersville Synclinorium. In the vicinity of the dam the beds have a fairly regular N65°E strike and nearly vertical dip. Bedding plane thrust faults are mapped on both sides of the valley.

Fracture traces trend N80° to 85°W, N20°W and N10°E.

Overburden

The construction drawings indicate that the overburden at the dam site varied from ten feet thick on the right side of the dam to sixty feet on the left. The material is characterized as "loamy earth" over weathered bedrock where thin, and sandy clay were thick. Five to ten feet of weathering in the bedrock is noted.

Aquifer Characteristics

While some of the sandstone units in the Mauch Chunk Formation may have some primary porosity and permeability, most or all, ground water movement is along bedding planes and fractures. Since the grains and cement of the rock are essentially insoluble minerals, there is little chance of enlargement of fracture openings by ground water movement.

Discussion

This dam was constructed with a concrete core wall. On the right side the core wall is founded in fresh sandstone, while on the left side it is founded in sandy clay. Some leakage was noted after completion and weirs were installed. There was no increase in the leakage during the 1920's. In 1945 it was reported that one of the leaks is constant through the year, while the other dries up when the lake level is more than four or five below the spillway.

Some of this leakage is probably through the bedrock below the dam. The dam is built at right angles to the beds, and the bedding planes make natural paths for leakage, and being vertical would be difficult to seal with grout. As noted above, leakage through the bedrock is unlikely to increase with time, as there are no soluble minerals in the rock.

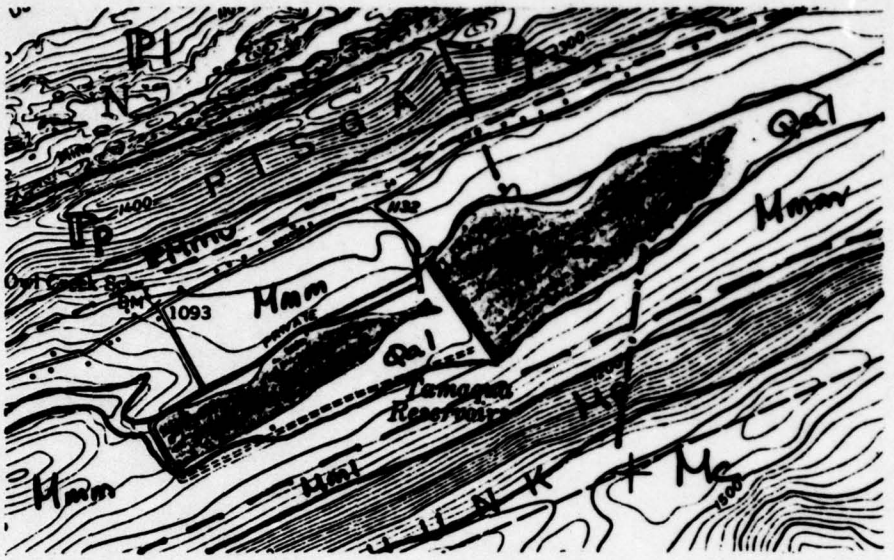
Sources Of Information

1. Wood, Gordon H. (1974) "Geologic Map of the Tamaqua Quadrangle, Carbon and Schuylkill Counties, Pa."

2. Air Photographs, scale 1:24,000, dated 1969.

3. Core boring information in file.

GEOLOGIC MAP — Tamaqua Reservoir Dam



(geology from U.S.G.S. Map GQ-1133)

Qal	Alluvium	Mp	Pocono Fm.
Pl	Llewellyn Fm.	Mc	Catskill Fm.
Pp	Pottsville Fm.	— — —	thrust fault
PMmu	Mauch Chunk Fm; upper member	—·—·—	air photo fracture trace
Mmm	Mauch Chunk Fm; middle member		
Mml	Mauch Chunk Fm; lower member		

SCALE 1:24000

1 0 1 MILE

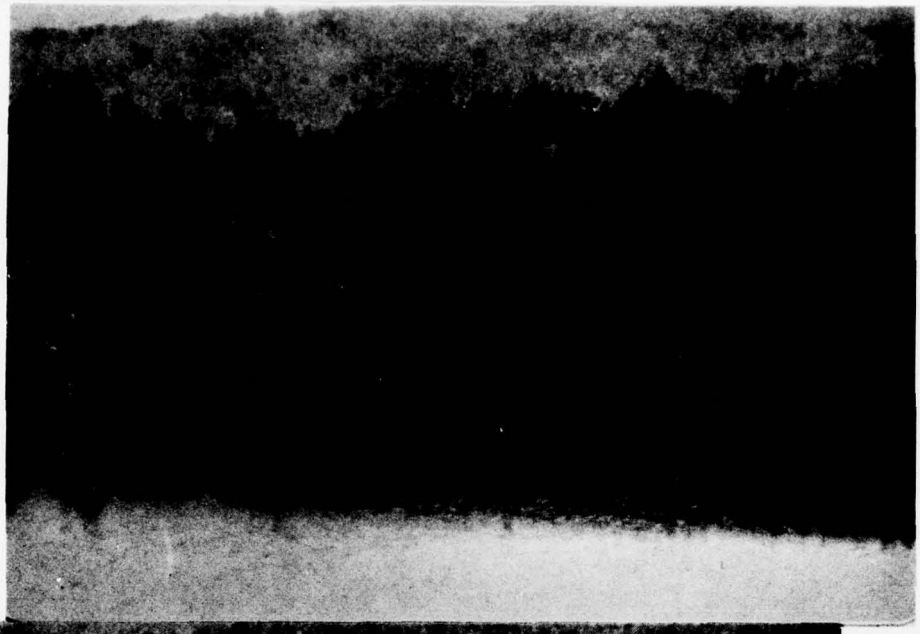
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

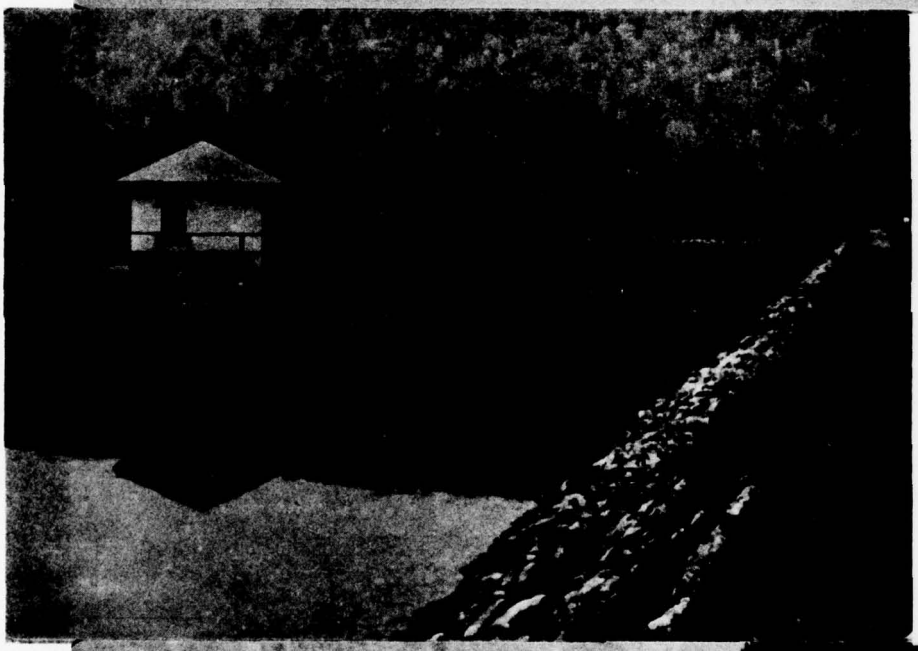
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

APPENDIX E

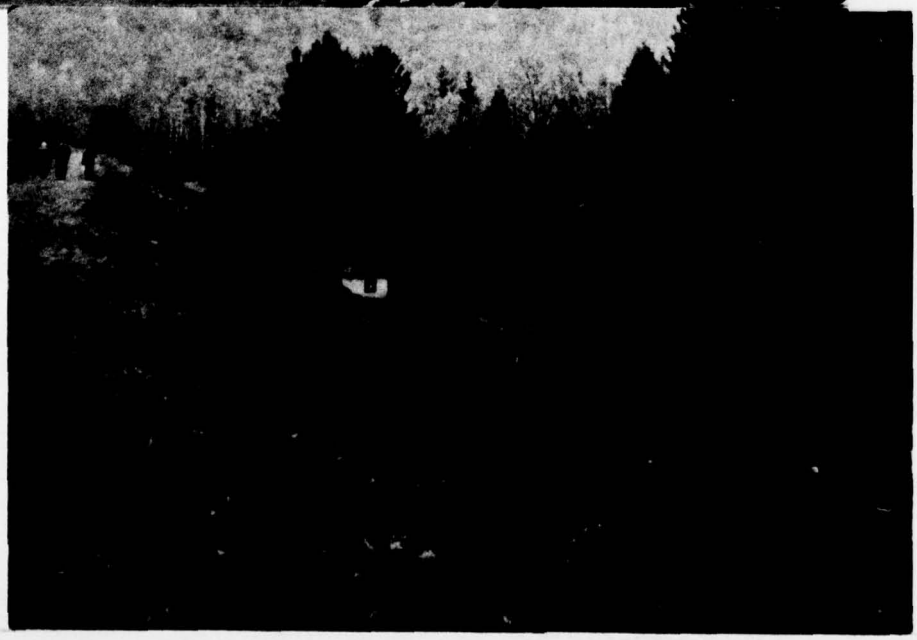
PHOTOGRAPHS



Upstream Slope



Upstream Embankment
and
Intake Structure



Downstream Slope
and
Valve House

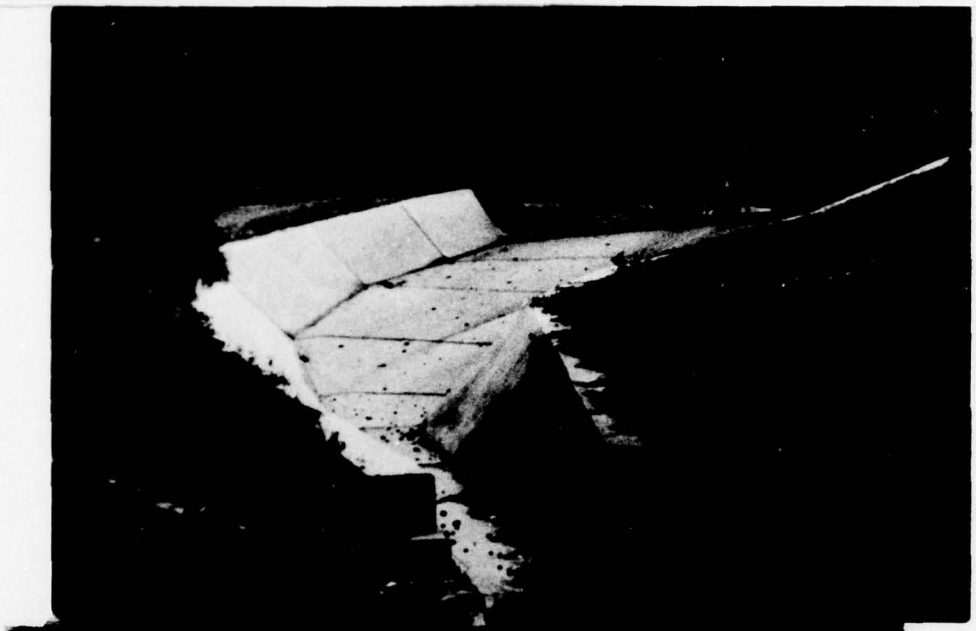
PA-673
PLATE E-I

Toe of Downstream Slope, Toe Drain and Cut Trees

Valve House and Aeration Pipes

Spillway Weir & Footbridge

PA-673
PLATE E-II



Spillway Chute

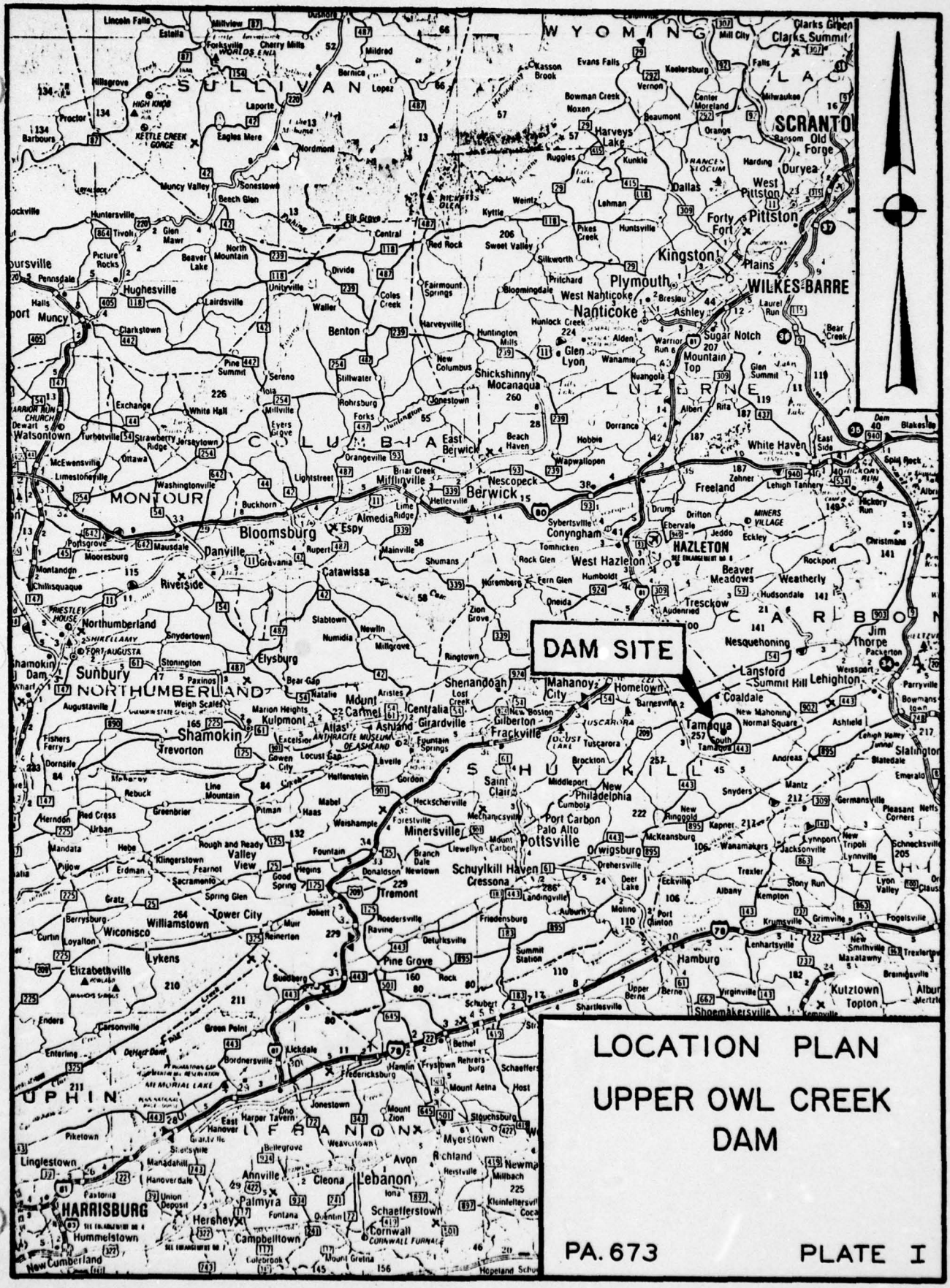
Discharge Chute

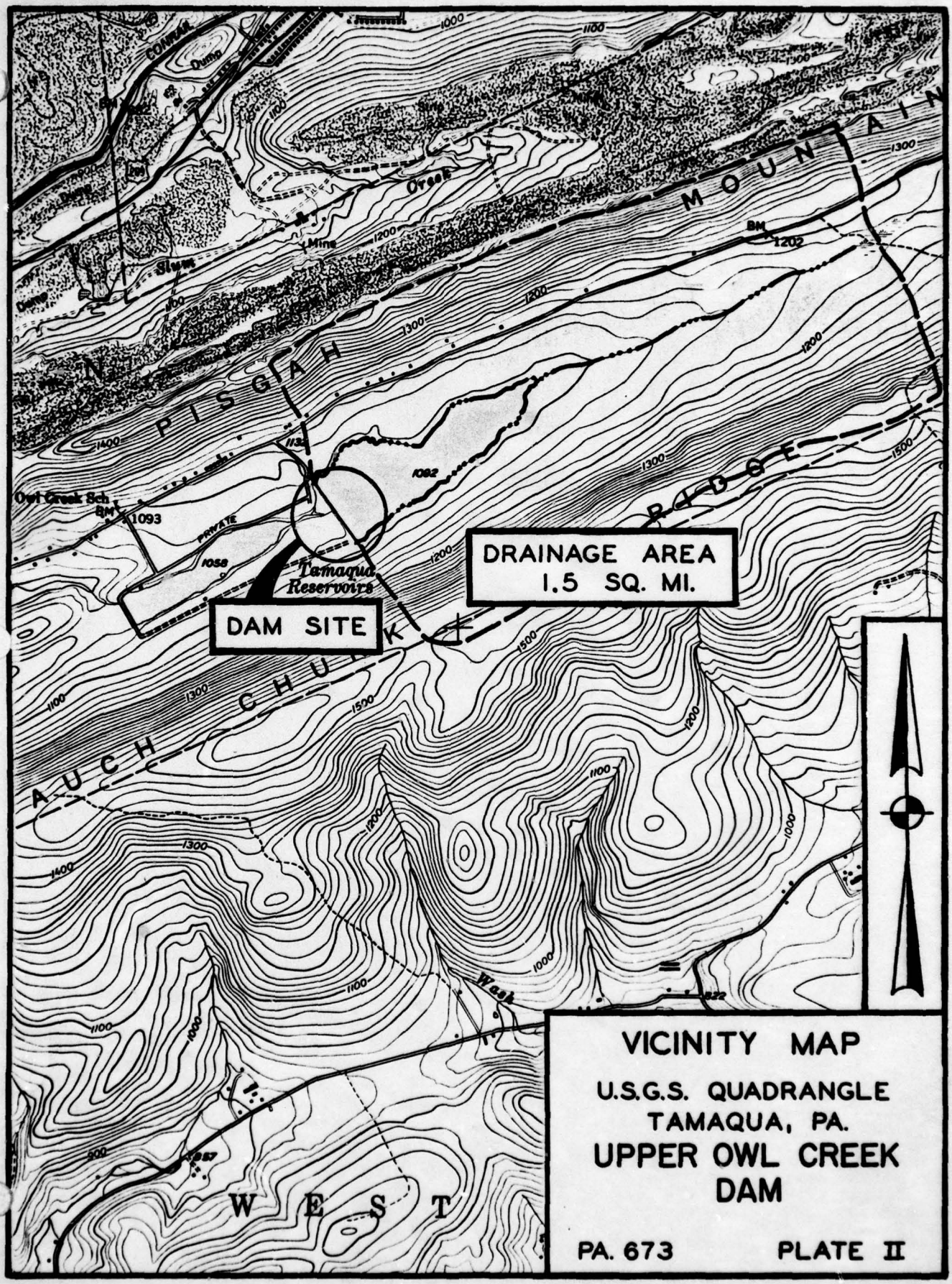
Discharge Channel

PA-673
PLATE E-III

APPENDIX F

PLATES


DAM SITE
LOCATION PLAN
UPPER OWL CREEK
DAM
PA. 673
PLATE I

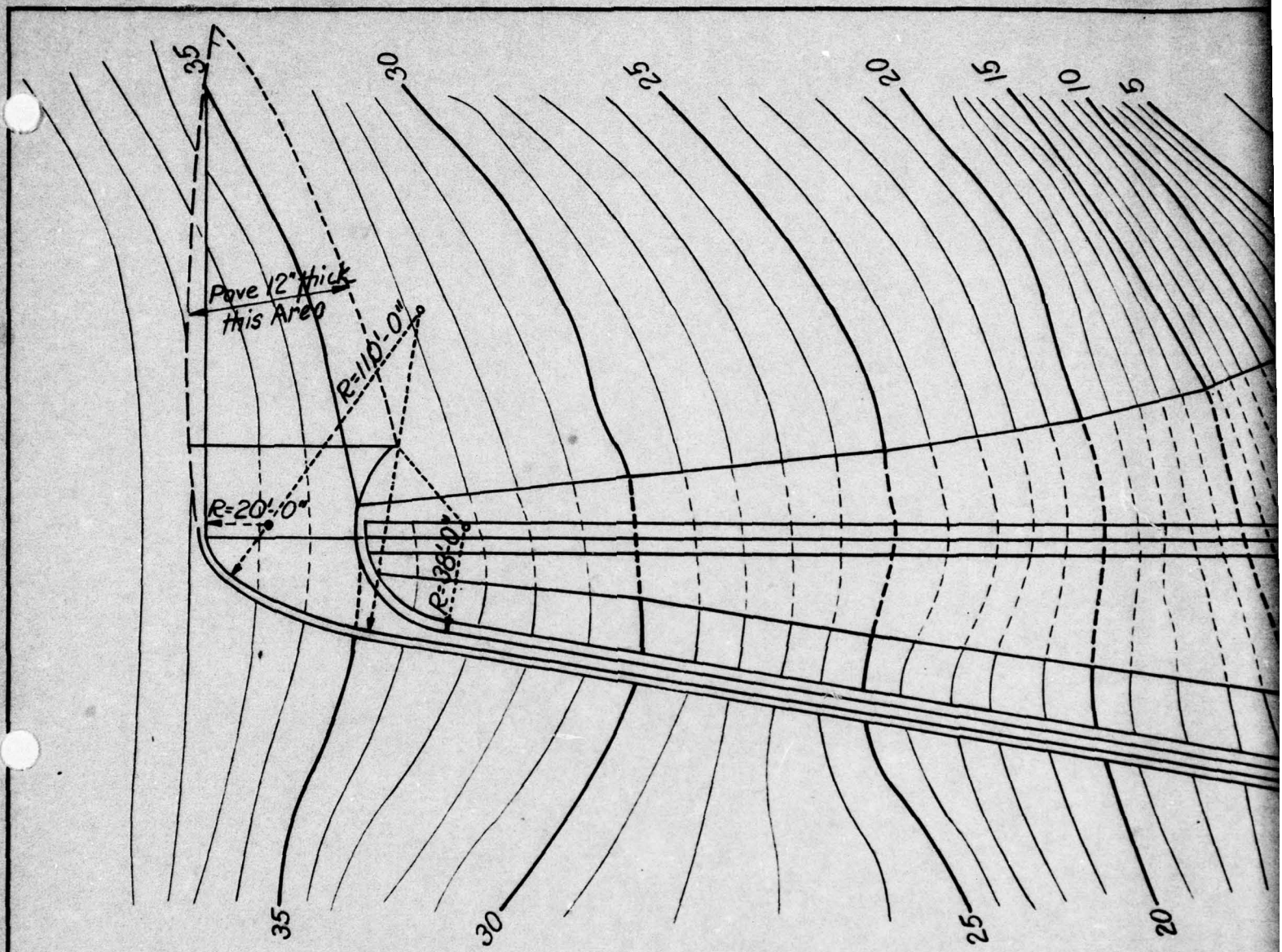


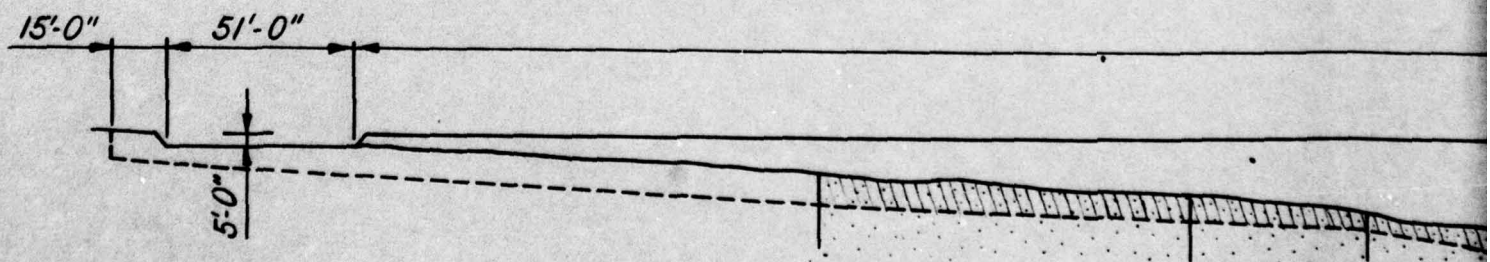
VICINITY MAP

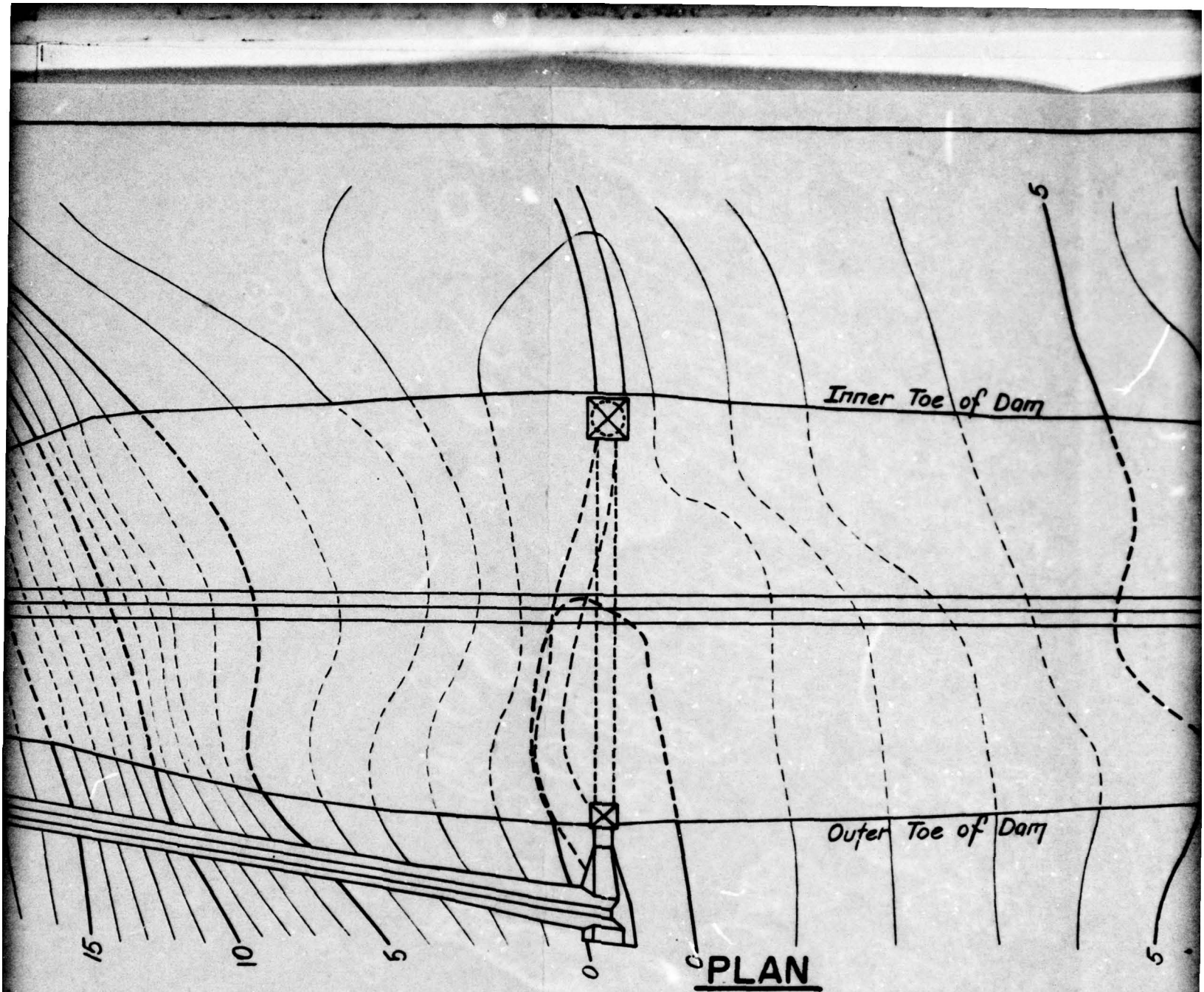
U.S.G.S. QUADRANGLE
TAMAQUA, PA.

UPPER OWL CREEK DAM

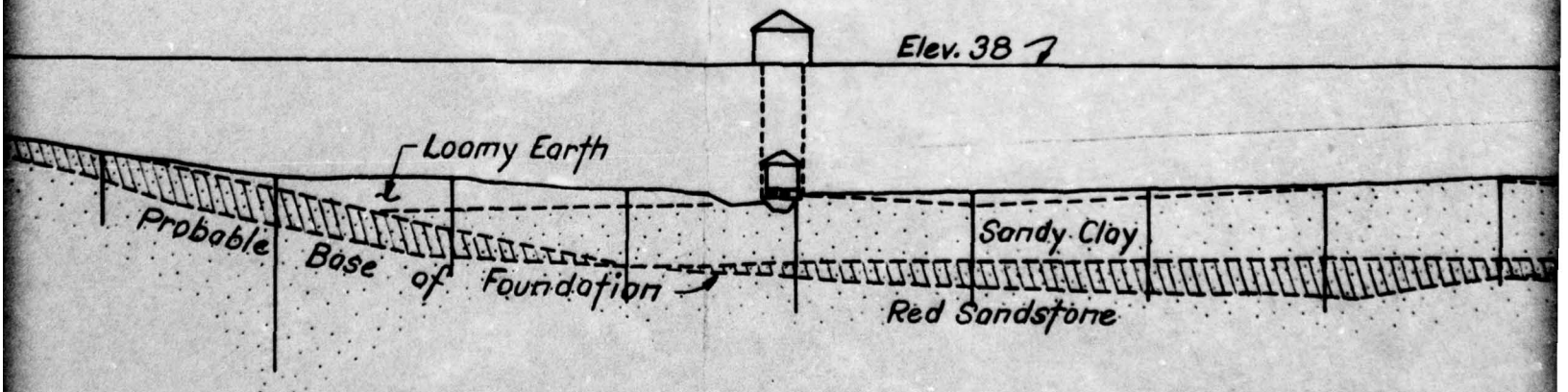
PA. 673 PLATE II


35
30
25
20
15
10
5
Pave 12" thick this Area
R=110'-0"
R=20'-0"
R=30'-0"
35
30
25
20


15'-0"
51'-0"
5'-0"



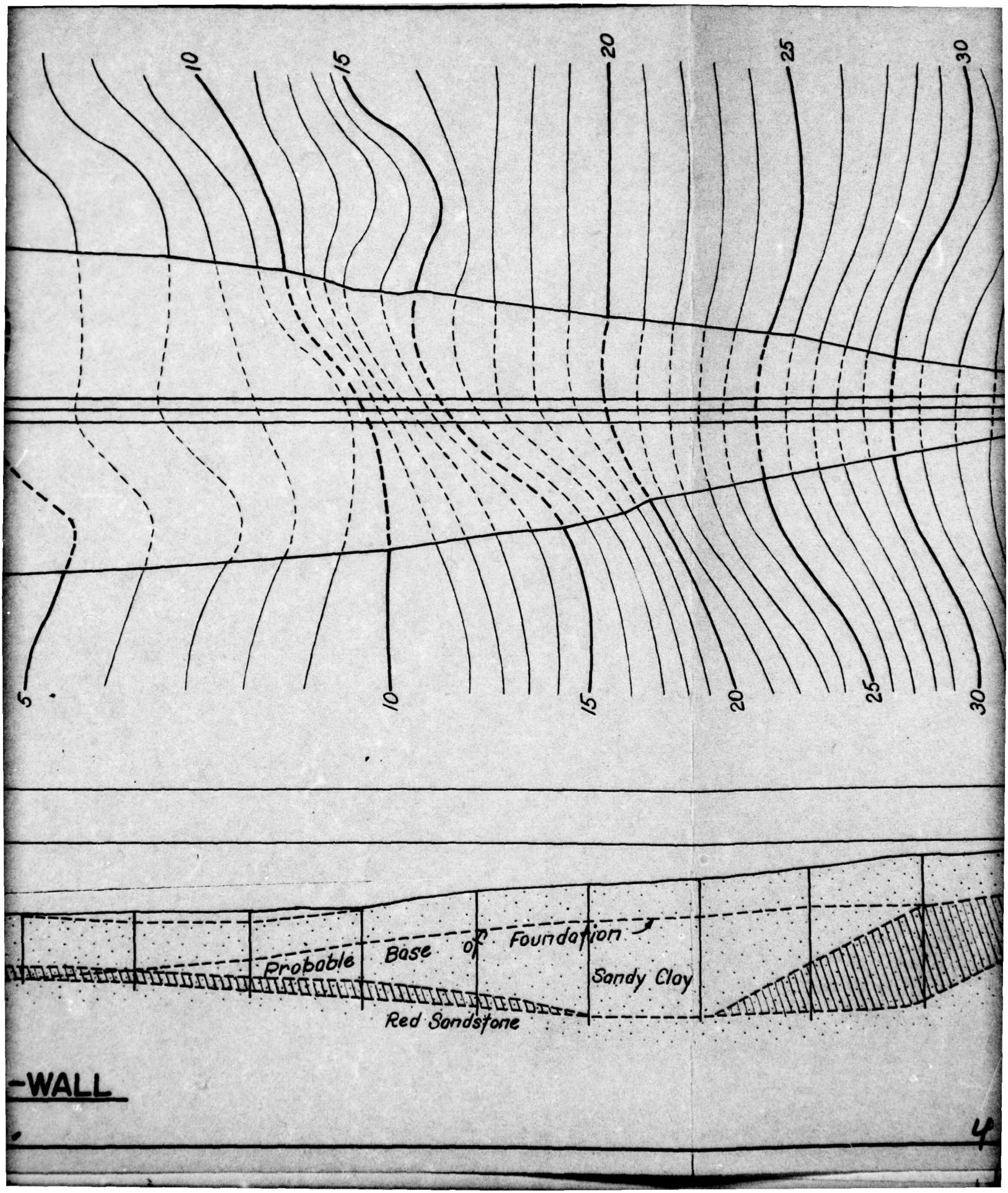
PLAN



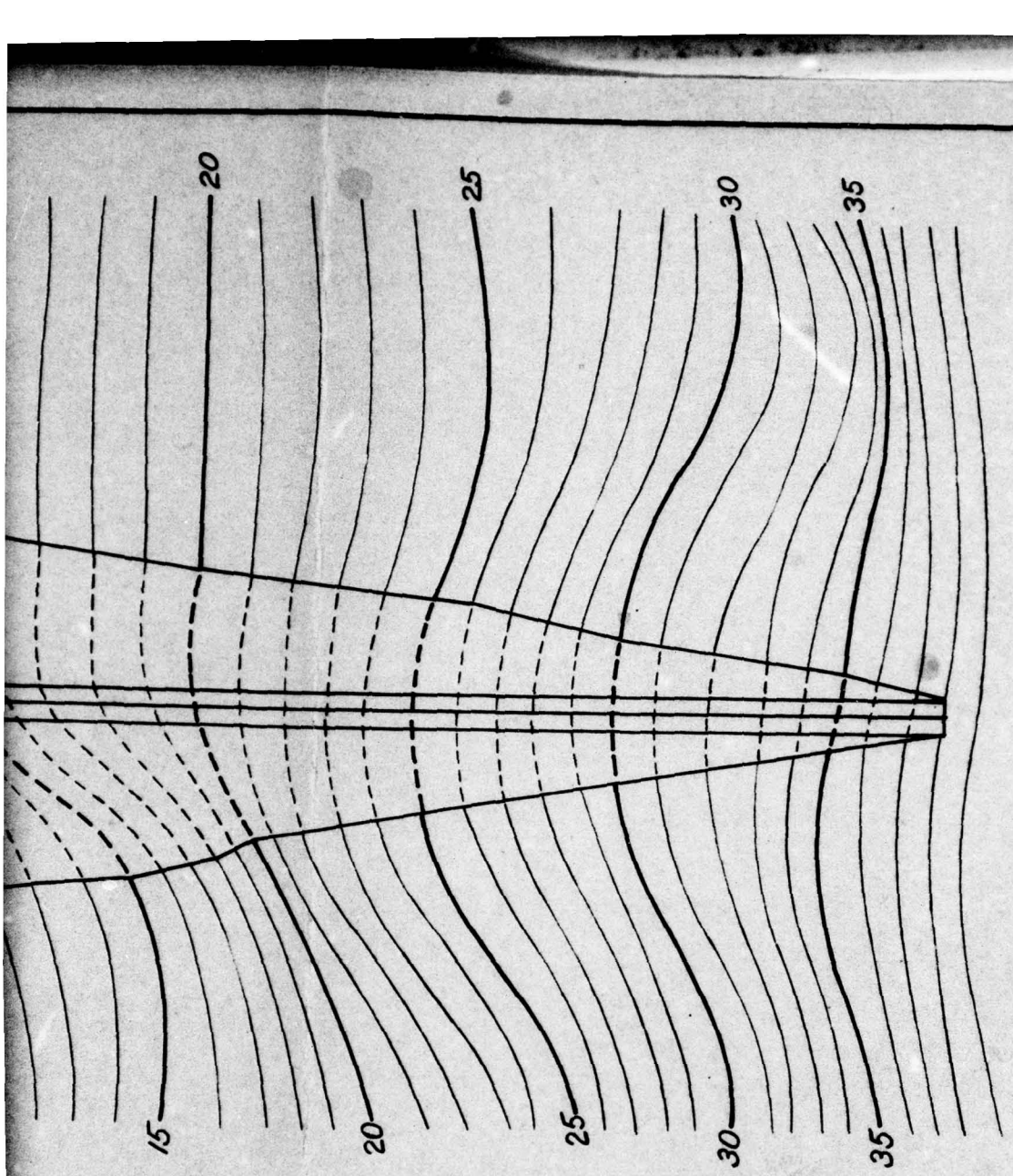
LONGITUDINAL SECTION ON CENTER OF CORE-W

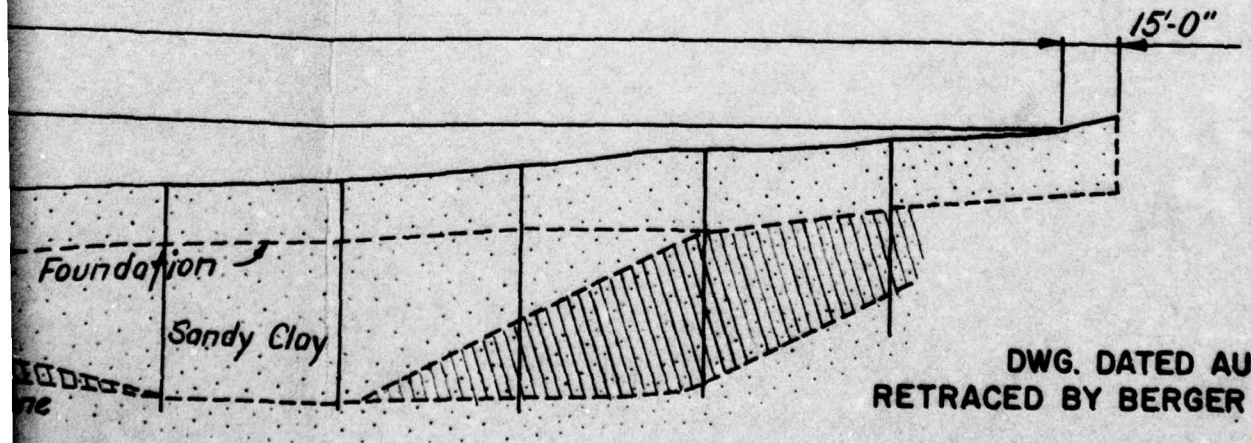
2.

3.


10
15
20
25
30
5
10
15
20
25
30
Probable Base of Foundation
Sandy Clay
Red Sandstone

-WALL

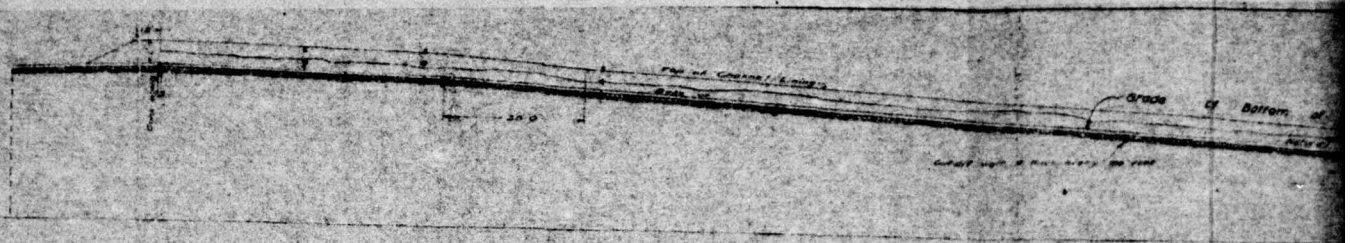


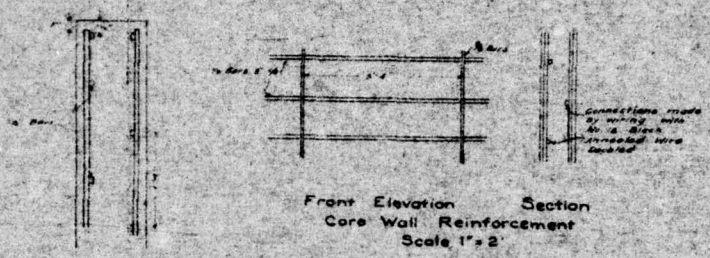


DWG. DATED AUG. 10, 1915
RETRACED BY BERGER ASSOC. DEC. 1978

UPPER OWL CREEK DAM PA. 673

PLATE III



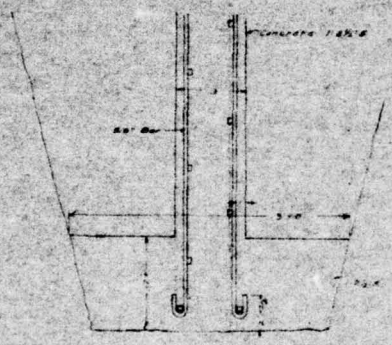


Front Elevation Section
Core Wall Reinforcement
Scale 1"=2'

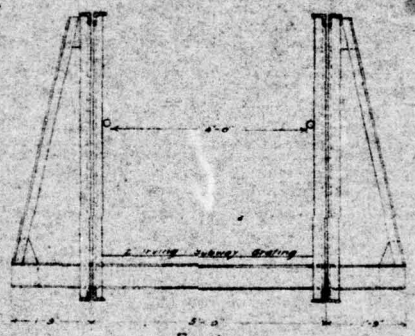
PLANS OF PROPOSED DAM ON OWL CREEK FOR TAMAQUA BOROUG

May 10, 919 J.H. Lauer Cons. Eng.

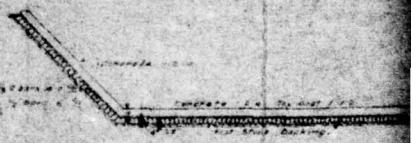
SHEET 3



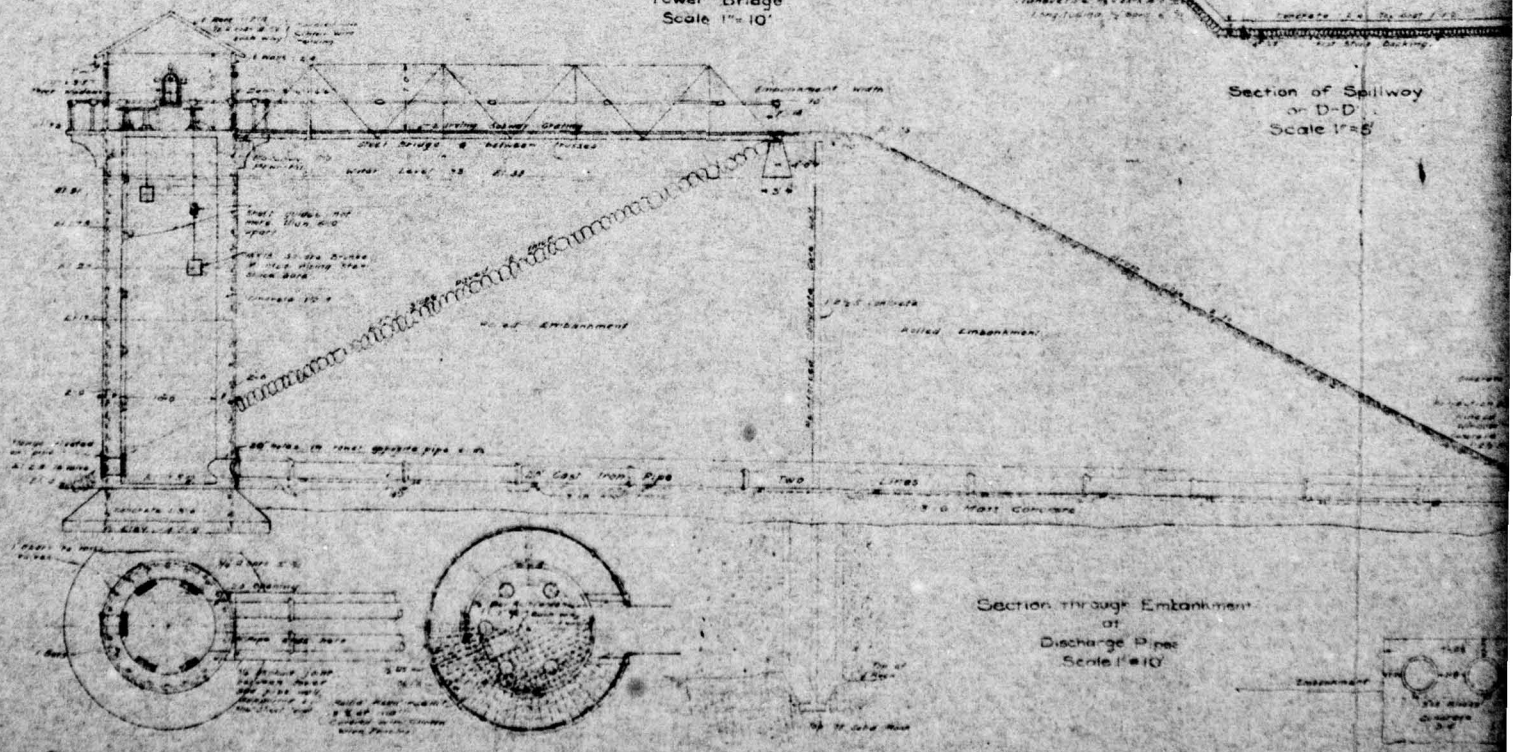
Section
of
Core Wall
Scale 1"=1'



Section
of
Tower Bridge
Scale 1"=10'



Section of Spillway
on D-D'
Scale 1"=5'

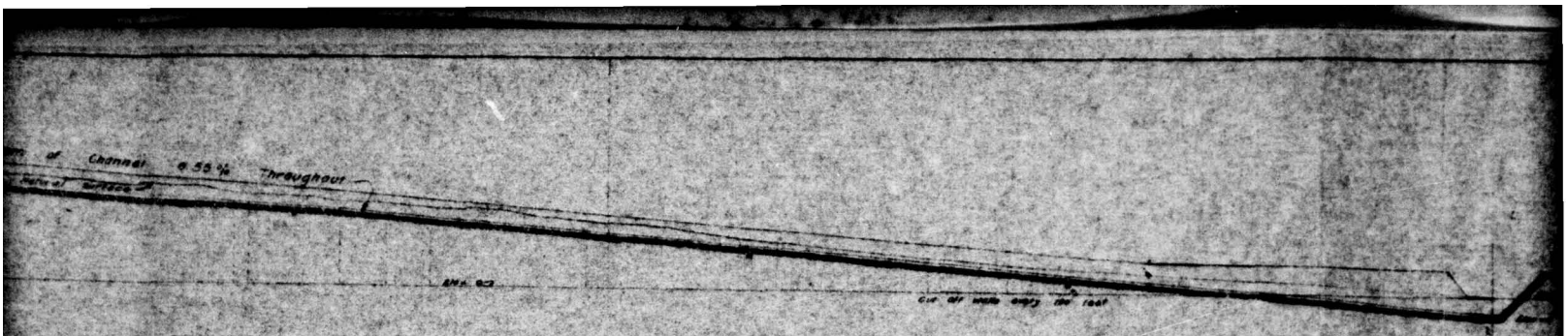


Section through Embankment
at
Discharge Pipes
Scale 1"=10'

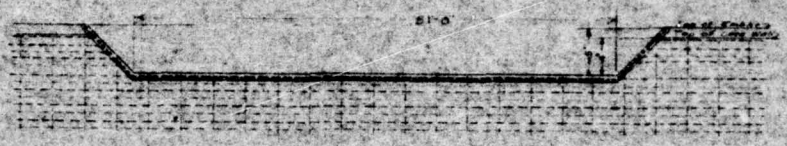
Section of Outlet Tower
Scale 1"=10'

Outlet Tower Floor
Scale 1"=10'

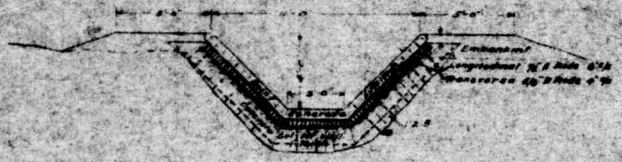
Section of Discha
Scale 1"=



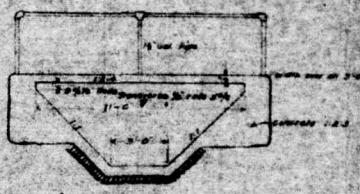
Profile of Spillway
Scale 1"=20'



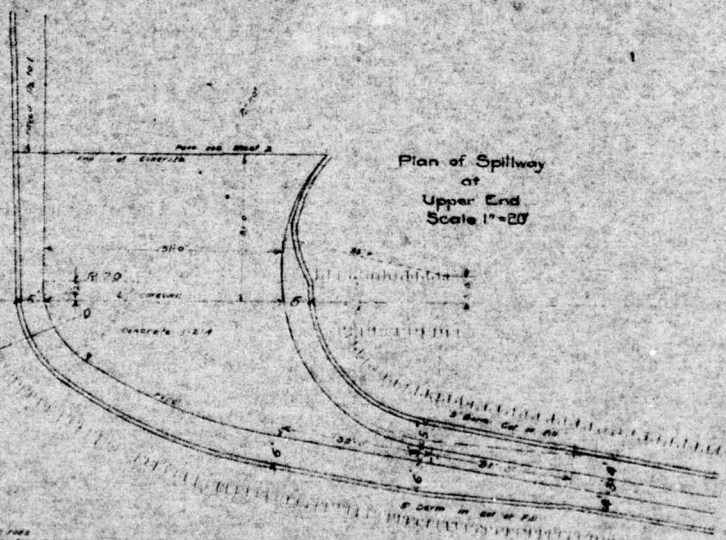
Section
of
Spillway at Core Wall
Showing Reinforcement
Scale 1"=10'



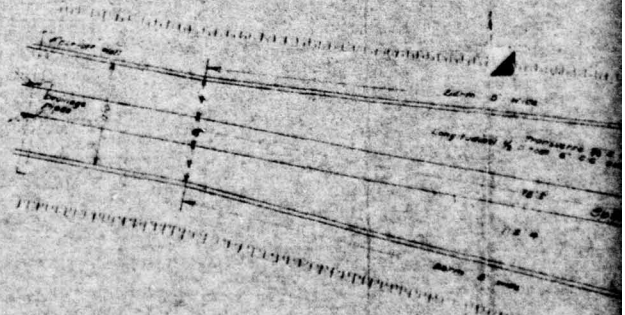
Normal Section
of
Spillway
Showing Cut-off Wall
Scale 1"=5'

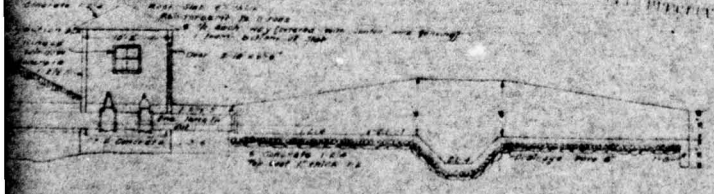


Side Elevation
of
Spillway Bridge
Scale 1"=5'

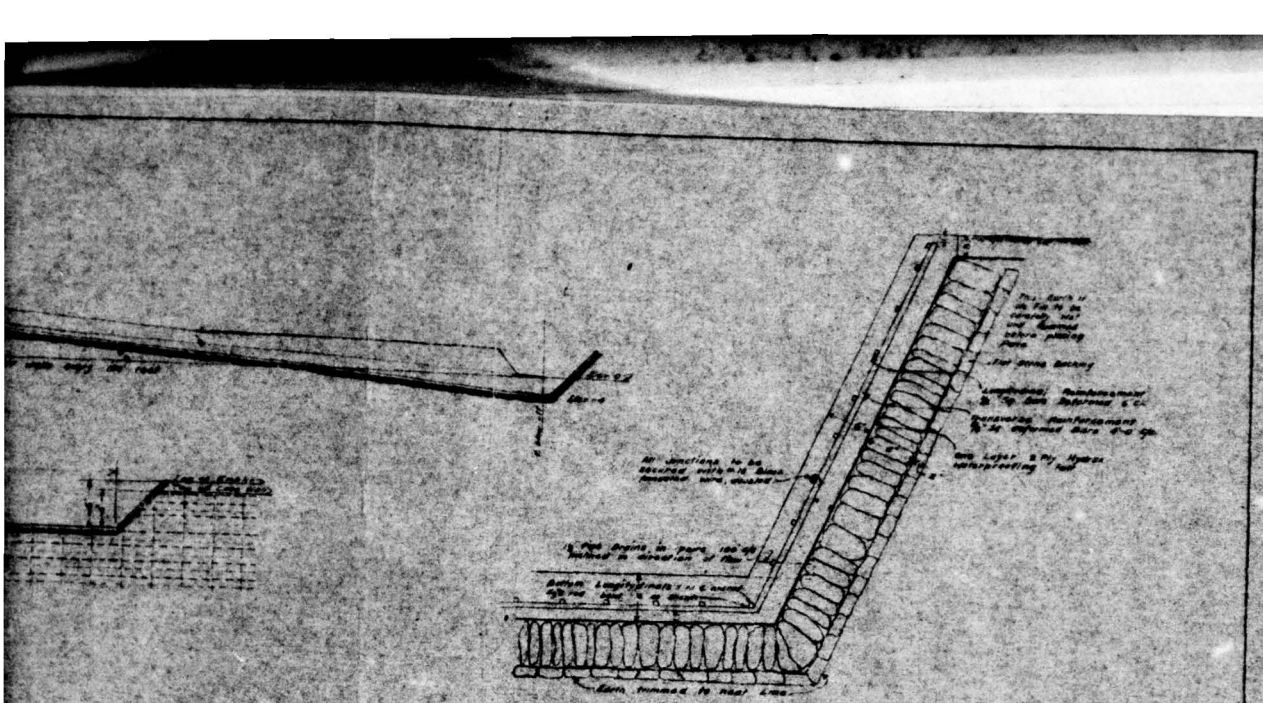


Plan of Spillway
at
Upper End
Scale 1"=20'

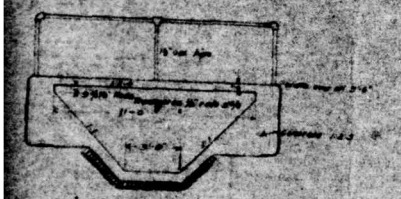




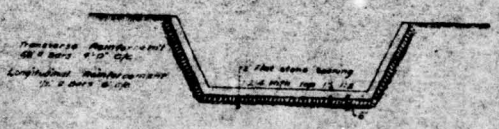
Section of Apron
on A-A'
Scale 1"=5'



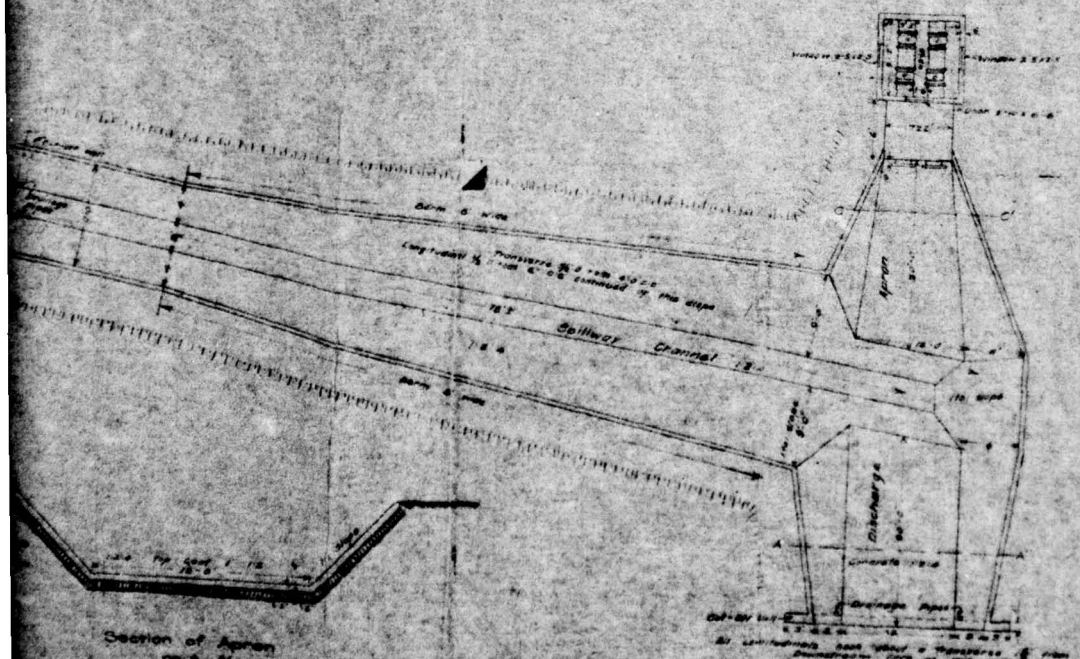
Enlarged Detail of Section
at C-C'
Typical of Entire Spillway Channel
and Discharge Apron
Scale 1"=1'



Side Elevation
of
Spillway Bridge
Scale 1"=5'



Section of Apron
on C-C'
Scale 1"=5



Section of Apron
on A-A'
Scale 1"=5'

Junction
of
Spillway and Discharge Apron
Scale 1"=5'

PA. 673
PLATE IV